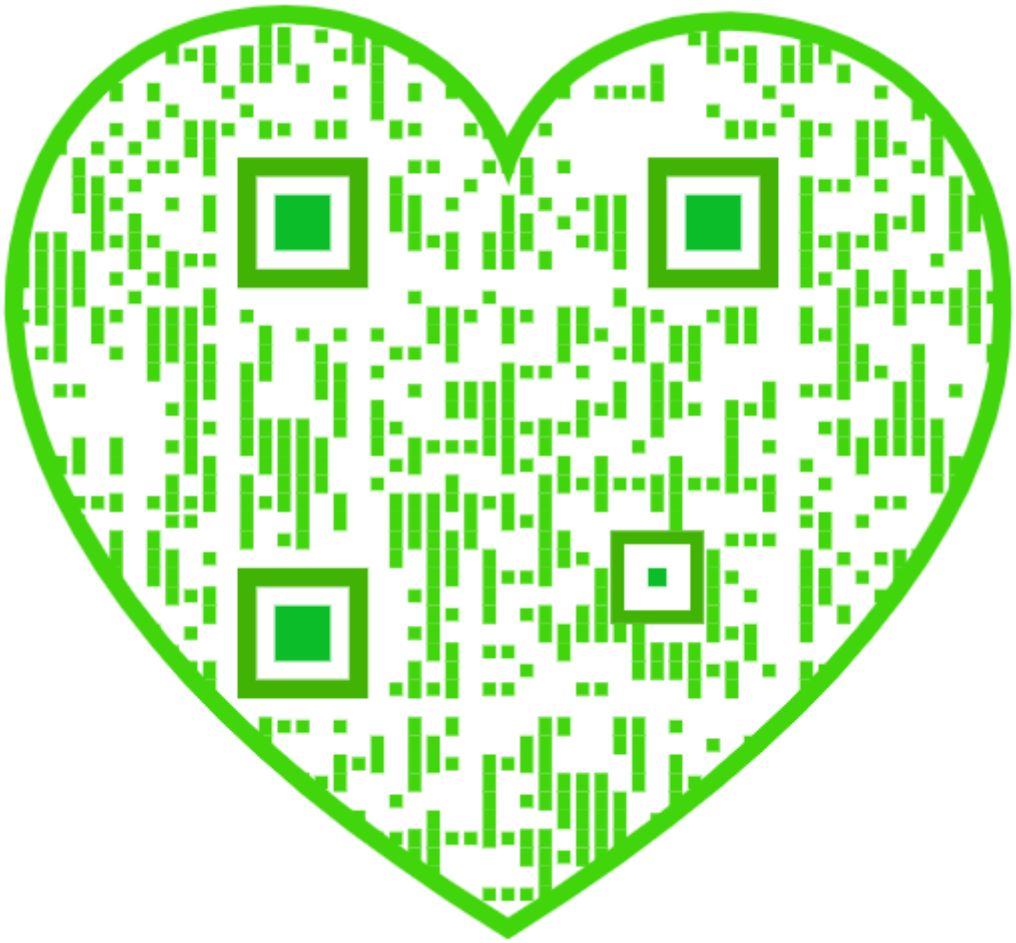
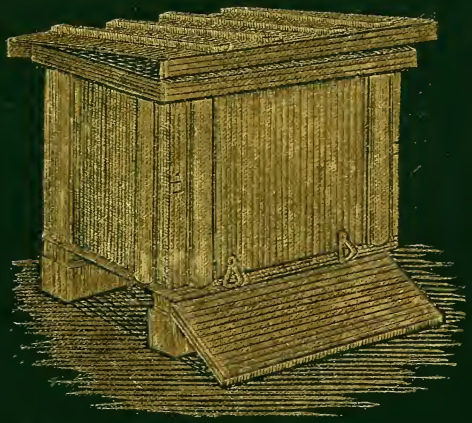




QUINBY'S

NEW BEE-KEEPING.

The Mysteries of Bee-Keeping Explained.

COMBINING THE RESULTS OF FIFTY YEARS' EXPERIENCE, WITH THE LATEST DISCOVERIES AND INVENTIONS, AND PRESENTING THE MOST APPROVED METHODS, FORMING

A COMPLETE GUIDE TO

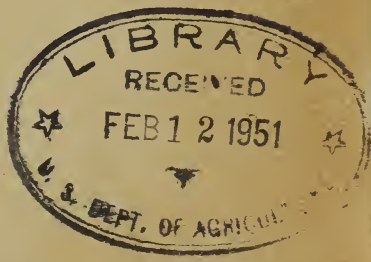
SUCCESSFUL BEE-CULTURE.

BY

L. C. ROOT,
PRACTICAL APIARIAN.

NEW AND REVISED EDITION.

ILLUSTRATED.



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CONTENTS.

PREFACE ..... IX-XI
MEMORIAL OF M. QUINBY XIII
INTRODUCTION 17
BEE-KEEPING; THE OLD AND THE NEW 17

CHAPTER I.—THE HONEY-BEE.

Simple Facts in Its Natural History—The Queen—Workers—Drones—Construction of Comb—Gathering and Storing Pollen—Gathering and Storing Honey—Propolis and Its Use—Brood Rearing When it Begins—Form of the Brood-nest—Process of Egg-laying—Preparations for Swarming—Facts and Theories Concerning Generation—Fertile Workers 23-39

CHAPTER II.—ITALIAN BEES.

Italian or Ligurian Bees—First Introduced into America—Characteristics—How to Procure Italians—Color not an Absolute Test of Purity—Other Varieties 39-48

CHAPTER III.—SOURCES OF HONEY.

Sources of Pollen—Early Honey Plants—Singular Fatality Attendant on Silk-weed—Basswood—Later Honey Plants—Buckwheat—Honey Dew—Do Bees Injure Grain and Fruit?—Injury to Ripe Fruit—How far will Bees go for Honey?—Best Season for Honey 48-66

CHAPTER IV.—THE APIARY.

Preliminary Study—Location—Immediate Surroundings—Bee-Keeping in Cities and Villages—Arrangement of the Hives—Distance Between Hives—Hives should Set Level—Disadvantages of High Stands—Marking the Location—Moving Bees Short Distances—Shade—Bee Houses—House Apiary—When to Purchase Bees—Where to Buy—Transportation Beneficial—How to Select Swarms—Expense of Bees and Fixtures—Transporting Bees—Taking Bees on Shares—Financial Results—Overstocking 66-87

CHAPTER V.—CONTROLLING BEES.

Their Disposition—Smoke a Controlling Agent—Modes of Using Decayed Wood—Quinby Smoker—Means of Protection—Suitable Dress for Women—Interest Dispels Fear—Remedies for Stings 87-94

CHAPTER VI.—Hives and Boxes.

Movable Comb Hive—Construction and Advantages—Intelligent Manipulation Necessary—Hanging Frame or Langstroth Hive—Frames—Division Board—Side-boxing Hives—Observatory Hive—New Quinby Hive—Standing Frame—Panels or Side-boards—Small Bottom-board for Quinby Frames—Outer Case not Always Essential—Complete New Quinby Hive—Position of the Frames—Stands for Hives—Alighting Boards—Roofs—Painting Hives—Accuracy Essential—*Honey Boxes*—Section Frames Objectionable—Two-comb Boxes—Block for Setting up Boxes—Single-comb, or Section Boxes—Construction of Section Box—Guide Combs—Separators—The Clamp..... 95–125

CHAPTER VII.—Transferring.

Advantages—Time to Transfer—Preliminaries—Process.....125–129

CHAPTER VIII.—Queens.

Importance of Selecting Good Stock—Fertilization in Confinement—*Rearing Queens:* When to Rear—How to Rear Queens—Another Method—Forming Nuclei—Queen Nursery—Queen Cages—Introducing Queens—Clipping Queens' Wings—Process—How to Handle a Queen—Age of Queens—Drone Laying Queens—Loss of Queens—Indications of Loss—More than one Queen in a Hive 129–152

CHAPTER IX.—Natural and Artificial Increase.

Natural Increase—When Swarming Commences—Indications of Swarming—Preparations—Which Bees Compose the Swarm—Immediate Indications of a Swarm—How to Hive them—Emergencies—Separating Swarms—Swarms Returning to the Old Hive—After-Swarms—Preventing After-swarms—*Artificial Increase*—Straight Combs—*Controlling Swarming*—Non-Swarming Hives—Methods—Depriving of a Queen—Suggestions—Hints for Exceptional Seasons..... 152–172

CHAPTER X.—Boxing and Surplus Honey.

Putting on Boxes—Removing Boxes—Care of Box Honey—Presence of Larvæ—Suggestions for Securing Choice Specimens of Honey..... 172–179

CHAPTER XI.—The Honey Extractor and its Use.

Its Value—Description—Desirable Features—The Use of the Honey Extractor—When to Extract—Arranging Hives for Extracting—How to Extract—Curing Extracted Honey—Honey Knife—Securing Extra Combs of Honey—Securing Guide Combs—Relative Amount of Box and Extracted Honey. 180–190

CHAPTER XII.—Wax and Comb.

Wax—Honey-Comb—Size of Cells—Hexagonal Shape not Essential—Cost of Comb—Artificial Comb—Supplying Material for Comb—Comb-Foundation—Sheeting Wax—Wire in Foundation—Advantages of Wire—Heavy Foundation Preferable—Uses and Value of Foundation—Foundation in Surplus Boxes—To fasten Foundation in Frames—Expense of Foundation Machines—Rendering Wax.....190–203

CHAPTER XIII—Feeding.

Its Necessity—What to Feed—Preparing Food—Feeders—Honey in Combs for Spring Feeding—Feeding to Secure Surplus in Better Form—Honey Should be Warm when Fed.....204-211

CHAPTER XIV.—Robbing.

General Remarks—Indications—Remedies.....212-216

CHAPTER XV.—Diseases and Enemies of Bees.

Dysentery Foul Brood—Indications of Foul Brood—Remedy—Due to a Fungoid Growth—Remedy—Parasites—Bee Moth—Where their Eggs are Deposited—Development of the Larvæ—Destroyed by Severe Cold—Remedies—Moth-Proof Hives—Rats and Mice—Birds—Ants, Toads and Spiders.....216-231

CHAPTER XVI.—Marketing Honey.

Subject of Importance—Neatness—Objection to Large Cases—Two-story Cases—Small Cases Popular—Preparing Boxes for Market—Grading Honey—Packing Honey—Marking Cases—Reliable Dealers—Material for Cases—Manufacturing Cases—Transportation—Preparing Extracted for Market—Process of Liquefaction—Kind of Package.....232-240

CHAPTER XVII.—Wintering.

Preparing Bees for Winter—Perfect Quiet Essential—Out-of-Door Wintering—In-Door Wintering—Artificial Heat—Dryness—Best Arrangement of a Cellar—A Special Building for Wintering—Clamps—When to Place Bees in Winter Quarters—Flight during Winter—Setting out Bees too Early in Spring—Healthy Excrement always Dry.....241-255

CHAPTER XVIII.—Honey.

Uses as Food and Medicine—Adulteration of Syrups—Different Qualities of Honey—Extracted Honey—Adulteration of Honey.....255-260

CHAPTER XIX.—Notes for the Seasons.

Spring—Summer—Autumn—Winter.....260-263

CHAPTER XX.

Conclusion.....263-264

LIST OF ILLUSTRATIONS.

Queen .. 24
Groups of Bees 25
Worker 25
Sting of Worker 26
Drone .. 27
Eggs and Larvæ 32
Ovaries of the Queen 36
White Clover 50
Alsike Clover 51
Motherwort 52
Silkweed 53
Basswood or Linden 55
Fuller's Teasel 57
Wild Teasel 57
Smooth Sumach 58
Golden Rod 61
Hives upon Roofs at Ilion, N. Y. 69
View of Author's Apiary 71
House Apiary of J. H. Nellis, Canajoharie, N. Y. 78
The Quinby Smoker 91
The Quinby Smoker, Improved 91
The Bee Veil 92
Iron for Holding Frames 98
Hanging-Frame Hive and Cap 99
Hanging-Frame 100
Division Board 101
Observatory Hive 102
New Quinby Hive, with Frames and Boxes 103
Standing Frame 105
Hook on the End of Standing Frame 106
Form for Building Frames 106
Panel for Side of Frames 107
Panel, Improved 107
Small Bottom-board for Quinby Hive 108
Quinby Frames and Boxes in Clamps 109
Large Bottom-board, with Frame 110
The Quinby Hive Clasp 111
The Quinby Hive with Roof 112
Roof for Hives 113
Tin for Corner Posts of Boxes 117
Two-Comb Box, & Honey-Board 118
Block for Setting up Boxes 119
Standard for Tops of Boxes 119
Tin Point for Holding Glass 121
Section Boxes 121
Form for Making Section Boxes 121
Separator 122
Improved Separator 123
An Empty Clamp 123
Clamp Filled With Boxes 124
Frame Containing Six Boxes 124
Frame Containing Three Boxes 124
Transferring Board 126
Transferring Sticks 126
Transferred Combs 128
Nucl us Box 133
Comb with Brood for Queen Raising 134
Comb with Brood Inserted in Comb 134
Queen Cells Built upon Comb 135
Queen Nursery 136
Queen-Cell Box 141
Queen Cages 143
Queen with Clipped Wing 147
Brood of Drone-laying Queen in Worker Cells 150
Queen Cells over Drone Brood 150
Cluster of Queen Cells and a Queen Cell cut from Comb 156
Everett's Honey Extractor 180
The Excelsior Honey Extractor 181
A Two-story Hive 184
Van Deusen's Clasp 184
Straight Honey Knife 188
Curve-pointed Honey Knife 188
Bingham & Hetherington's Honey Knife 188
Abdomen of Bee with Scales of Wax 190
Machine for Making Metallic Comb 193
Manner of Setting up Metallic Combs 194
Distorted Cells in Foundation 197
Comb Foundation with Wires 197
Machine for Making Worker-Comb Foundation 198
Swiss Wax Extractor 202
The Author's Wax Extractor 203
Feeder for Quinby Hive on Panel 206
Van Deusen's Feeder 208
Method of Filling Combs for Feeding 209
The Honey Bug 222
Trichodes Apiarius 222
Seed-glass for Examining Parasites 222
"American Agriculturist" Simple Microscope 223
The Bee-moth in Different Positions 224
Gallery of the Bee-moth Worm in Comb 225
The Worm Gallery Removed 226
Larva of Bee-moth 226
Cocoons of Bee-moth 227
The Bee-killer 229
Three Sizes of Honey Boxes 234
Eight Five-pound Cases Recased 234
Twelve Cans of Extracted Honey in Case 240
Muth's Honey Bottles 241
Frames of Quinby Hive Prepared for Winter 244
Thermometer 250
Double Clamp for Wintering Bees 252

PUBLISHERS' PREFACE.

After the death of Mr. Quinby, the preparation of a new and revised edition of his work, which he had in contemplation, fell into the hands of Mr. L. C. Root, his relative and long-time business associate. This secured the incorporation of Mr. Quinby's latest views and methods, and the introduction of important improvements that had then just been tested, especially that of comb-foundation, and the treatise thus embodied the experience of two skilled apiarians. The work was so largely re-written by Mr. Root, that he might in justice have claimed to be its author, but with rare modesty, and in a spirit of reverence to the memory of one who had devoted his life to the advancement and popularizing of bee-culture, he preferred to retain the title of "Quinby's New Bee-keeping." In the present edition the work has been revised throughout, numerous pages and parts of pages have been cancelled and replaced by new ones; new engravings have been prepared, and the matter everywhere brought up to the present date. This has been done so thoroughly, as to make the present edition, what each previous one has been, the standard guide to bee-culture, presenting all tested improvements, and the latest views, both of the author and other workers in the same field of industry. The work is offered to the experienced bee-keeper as a reliable volume of reference, and to the novice as a guide in commencing the occupation of keeping bees. Annually vast quantities of honey literally "waste their sweetness on the desert air," for the lack of bees to secure and preserve it in a form in which it may be consumed or converted into money. It is hoped that this work, in its improved form, may aid many dwellers in rural districts to increase their luxuries and their incomes.

PREFACE TO REVISED EDITION.

In presenting this revised edition of "New Bee-keeping," I have but one object in view, namely, the desire to place Bee-keeping as a substantial branch of agriculture on a higher and broader basis.

There seems to be a wide-spread conviction that there is nothing new to be learned in Bee-keeping, and the number of bees yet kept in box-hives throughout the country is ample proof that there is yet a great work to be accomplished. I am of the opinion that even the majority of progressive bee-keepers fail to comprehend the ultimate possibilities of our pursuit. I have endeavored to bring this work fully up to the time, and to this end have described and illustrated all of the latest appliances and methods, which from actual experience have proved of value.

The price to be paid for progress in this, as in all other callings, is continuous labor and application, and whatever value this work may possess, lies in the fact that it gives the reader the benefit of the most extended practical experience of any work ever published upon the subject.

L. C. Root.

PREFACE TO THIRD EDITION.

It is well known to those familiar with the previous editions of this work, that Mr. Quinby wrote and offered it to the public, with a hope of awakening a clearer conception of the immense quantities of honey annually produced by the bloom of field and forest, and of utilizing these hitherto undeveloped resources, by encouraging a more general adoption of bee-keeping as a pursuit.

The figures which he gave at that time, seemed incredible to the uninformed, yet he lived to see his own expectations more than realized, in the rapid progress that has since been made.

During the latter years of his life, he was particularly anxious to embody his ripest experience, and most important discoveries, in a new and thorough revision of his book; and had his life been prolonged a few years, this work would have been done by his own hands.

Encouraged by the publishers, and inspired by the wish to fulfill his desire to keep step with the progress of his beloved pursuit, I have endeavored to prepare this revision, and compile the results of his experience; and thus, so far as lies within my power, carry out his idea of still farther elevating bee-keeping to the honorable position it deserves, as a scientific calling.

I have thought it desirable to retain, as far as possible, Mr. Quinby's original language upon points which he developed with much clearness, and in which but little, if any, advance has since been made. This is but just to him, when we remember how indefatigable and painstaking he was, in his efforts to arrive at the exact truth, when he was not only unaided by any of our modern facilities for investigation, but rather, was impeded by all the obstacles which popular ignorance and current prejudice could present.

I have been unable to reproduce literally much of his later writings on topics of recent development, as they

mostly appeared in periodicals, and needed condensation; yet, much of the matter presented is really but the result of his observations, expressed in my own language.

Very many views have been advanced as worthy of consideration and adoption, which might have been corroborated and strengthened, by quoting the sanction and practice of many reliable bee-keepers; but in many instances, I have omitted to do this for lack of space, trusting that all will believe that nothing has been recommended, that has not been put to a practical test.

I must express my indebtedness to many of our leading writers and practical apiarians, for many ideas and suggestions that have been of much value to me, and which, true benevolence dictates, should be disseminated for the good of all. And I am also under no small obligation to the enterprising "bee-men" of foreign countries, both of the past and present; and although belonging to far distant countries and nationalities, every true bee-keeper must feel that their love for the study of the Honey-Bee, is a bond of sympathy which makes us all brethren.

While I have thus been greatly aided in many ways, my confidence in an ability to accomplish Mr. Quinby's intentions, has been chiefly derived from the circumstances of my intimate association with him during the latter part of his life, when a half century of assiduous toil and study had well fitted him to become a teacher in his special vocation.

Combined with this, I have had an active personal experience of ten years in bee-keeping (making it my exclusive business); and thus, I hope to sustain the original reputation of this work, for "simplicity and reliability" and at the same time, to make it, what the author designed it to be, a comprehensive and practical treatise on ADVANCED BEE CULTURE.

L. C. ROOT.

MEMORIAL OF M. QUINBY.

By Capt. J. E. Hetherington, Cherry Valley, N. Y.

I approach the task before me with mingled feelings of love, admiration, and duty; love for the man, cemented by intimate friendly relations with him for more than twenty years. I went to him when a mere lad for instruction in bee-culture, and he so beautifully unveiled the wonderful mysteries of the natural history and practical management of the honey-bee, that I left him that day, impressed as I had never been before. As I afterwards learned to know him, I found that his kind, considerate manner, and evident pleasure in imparting instruction, were but the manifestation of qualities of heart and purpose, strongly marked in his character. My admiration for his sterling, manly attributes, and eminently useful life, inspire me to attempt, in a small measure, to discharge a duty resting on me, in common with every bee-keeper in the land; that of putting in some enduring form, a tribute to his unselfish life-work in promoting the science of bee-culture.

His writings have made their impress on bee-literature, and his name is familiar in every home where honey bees are kept for pleasure or profit. Thousands are to-day enjoying a delicious and wholesome article of food that would have remained ungathered, except for his earnest advocacy of the business as a source of revenue to the nation, and profit to the bee-keeper. He was ever unselfishly urging people to adopt this calling, that the millions of pounds of honey annually going to waste, might be garnered for the use of mankind; and he devoted

the best of his life to imparting instruction that would lead to this end. Thus, through his writings, and through his life-work for the benefit of mankind, he built to himself a monument more enduring than brass; and to complete the memorial, it is the wish of all who knew him to have inscribed on its tablet, that which will testify to his broad, christian character, as well as to such qualities of heart as are best revealed in home life to kindred and friends.

I was asked to write of Mr. Quinby because I knew him; none could know him but to love him. We, who were accustomed to gather at his fireside, can never forget his warm hospitality. He was of a happy, even temperament, always ready with a hearty welcome for his friends, and a kind word for every one; ever willing to spread the broad mantle of charity over the shortcomings of his fellows, yet equally prompt with quick censure for a wrong that could be righted.

True to his Quaker education, he was an intense hater of shams, especially of the human kind. He was honest, a characteristic that is getting to be as rare as it is valuable. There is no principle in business better established than that "Honesty is the best policy." Mr. Quinby, unlike many men, was honest from principle. His life-work was to elevate bee-keeping to the dignity of a pursuit among men, and he accomplished his mission.

Bee-keeping as a specialty will date from his time, and if Huber has earned the title of "Prince of Apiarists," certainly Mr. Quinby is entitled to that of "Father of Practical Bee-Culture."

In apiarian history there are four names that will stand out prominently beyond all others; Huber, the blind apiarian, who, by his untiring perseverance, discovered more of the interior workings of the bee-hive than any other man that ever lived; Dzierzon, the Quinby of Germany, who confirmed the hitherto unbelieved state-

ments of Huber, and added that equally surprising one of partheno-genesis; Langstroth, our own countryman, inventor of the movable comb-hive (the most important invention ever made in bee-culture), and author of a work, that for scientific accuracy and beauty of expression is unsurpassed; and last, but not least, our own Quinby, who, adding largely to the knowledge of his predecessors, combined the whole into a system of practical management, unequalled in simplicity and feasibility; and, finally, as a crowning act of a lifetime spent in the service of others, gave to the world his celebrated discovery that the liquid part of honey is, under favorable conditions, entirely evaporated within the body of the bee; a discovery second to none ever made in the history of the insect.

He was not only author of our most practical work on bee-keeping, but inventor of an almost perfect movable-frame hive, and the originator of numerous other useful devices. I predict that his invention of a smoker, combining the principle of an upright tube and bellows, will, in the near future, be in the hands of every bee-keeper in the land.

It has often been asked, "Why did not Mr. Quinby accumulate a fortune in keeping bees?"

To this question, I think this answer may be given: It is true that Mr. Quinby never became wealthy in a pecuniary point of view, but this was not because he was unable to make bee-keeping a lucrative pursuit. He did reap handsome profits in his business, but was continually distributing his gains in the search for more knowledge, and means for imparting it to others. His views of a true fortune did not permit him to enjoy the mere possession of money. With him, knowledge was better fortune than gold; and in another light, he considered the ability to do something for the benefit of mankind, a perpetual reward—treasures laid

up in heaven. Whenever he obtained any new idea that would benefit others as well as himself, it was forthwith given to all who would receive.

His life was, in every sense, a life of usefulness, and not wholly devoted to the interests of bee-culture, for he took a living interest in anything that he thought would benefit society; as an advocate and helper in the temperance work he did no mean service.

He possessed true kindness of heart, and believed it to be a religious duty to make all with whom he came in contact better and happier, and he regarded that life a failure that did not leave the world the better for having been lived. The following little incident tells its own story: On the day of his funeral, some bare-footed boys had followed down the street to the front of the house, where one of them turned up a sorrowful-looking face, and remarked to the officiating clergyman: "I am sorry Mr. Quinby is dead;" on being asked why, he replied, "He gave us apples, and pears, and sometimes grapes." They then asked if they might see him.

Generally, sickness, as a warning for preparation, precedes dissolution, but in the case of our friend, at the small hours of night, when reposing in quiet slumber, the message came. His wife noticed an unusual breathing—she immediately called the family, but before they reached the bed, he had answered the summons. A noble spirit had fled back to its Maker, a loving family circle was broken, and the earthly life of the Pioneer Bee-keeper closed.

Thus, at the age of sixty-five, ended the life-work of our counsellor, friend, and public benefactor. How fitting that a life so pure should have so peaceful an ending. He passed from earth—

> "Like one who wraps the drapery of his couch
> About him, and lies down to pleasant dreams."

INTRODUCTION.

BEE-KEEPING: THE OLD AND THE NEW.

Fifty years ago, Mr. Quinby, then a lad of nineteen, procured his first hive of bees, and began bee-keeping. He was wholly unacquainted with their management, save with the simplest directions for hiving swarms, and the use of brimstone for securing the honey, when desired.

A practical, instructive treatise on bee-culture was not to be found, and a periodical devoted to the subject was as yet unthought of. The prevailing ignorance of the simplest facts in their natural history, with the consequent inability to rationally explain the causes of prosperity or failure, was the foundation of a wide-spread belief that "luck" was the presiding genius of the bee-hive.

Signs and superstitions of all kinds were current in the lack of more intelligent teachings, and the good old man who warned Mr. Quinby against his habits of study and examination into everything in and about a bee-hive, but reflected popular opinion, when he said: "Your bees will never do anything if you potter with them so much."

In those days, the only hives were sections of hollow logs, boxes of various dimensions, and curious cones built of straw, which certainly attested to the ingenuity, if not to the progress of the age. If honey was wanted, recourse was had to the brimstone pit, and the unhappy bees were doomed to yield up not only their diligently gathered treasures, but their lives also; a sacrifice to ignorance, not without parellel in the history of the human race.

By and by, gleams of better methods began to dawn, and the most enterprising saw glimmers of a more rational system of treatment, which should secure the products without the destruction of the producers.

Rough, uncouth, wooden boxes were constructed and placed upon the hive, and the bees had access to them through holes bored in the top. These were succeeded by others more neatly made, with a hole in each end, covered with glass that the progress within might be inspected.

Thus, the first steps in the right direction being taken, it was easy to devise boxes with glass sides; and twenty-five years ago, we find Mr. Quinby recommending boxes six inches square, with glass on all four sides, with the remark that, "the expense of making is a little more for the same amount of honey, yet, when it is marketed, a few customers will prefer this size." Up to that date, the chief advance in practice, seems to have been in the better adaptation of the box-hive to the production of surplus.

Mr. Quinby's desire to understand the minutest details of everything which came under his observation, led him to become thoroughly familiar with the habits of his little favorites; and, unaided by the discoveries of foreign writers with which he was then wholly unacquainted, he demonstrated for himself many of the facts and principles which the progress of to-day easily enables us to verify.

At the end of a quarter of a century, he had so satisfactorily established a system of bee-keeping that would insure reasonable return for a stated investment, that he felt warranted in publishing the first edition of this work entitled "Mysteries of Bee-keeping Explained." He hoped thereby to benefit others by disseminating the knowledge he had acquired, and to encourage an industry, evidently designed by the Creator, when he caused uncounted flowers to annually secrete tons of liquid honey, and created a tiny insect with instinct to gather and preserve this "treasure-trove."

Simultaneously with this publication, appeared the first edition of "Langstroth on the Hive and Honey Bee." These two works were the first of any great value that had been written in America.

Their coincident appearance was always a great gratification to Mr. Quinby, as it afforded no opportunity for either to accuse the other of profiting by his investigations; and gave to both the honor of much original discovery.*

These books were subsequently revised, Mr. Langstroth's in 1859, and Mr. Quinby's in 1865. About this time, the "Bee-keeper's Directory" by J. S. Harbison, appeared. Mr. Harbison was the pioneer bee-keeper of California, and has done much to develop bee-culture in that State.

Mr. Langstroth's book marked an era in bee-culture; the invention of movable combs, therein elucidated, opening a field which all enterprising apiarians feel to be almost unlimited. A more accurate knowledge of the functions, and habits of the bee, improved methods of obtaining surplus, control of the interior economy of the hive, and many other advantages were derived from this invention.

From this period, progress began to be more rapid, and with each progressive step the facilities for improvement were proportionally increased. The next great discovery, that liquid honey might be removed from the combs without injuring them, gave to bee-keeping a still greater impetus.

The last ten years have given us Mr. Quinby's discovery concerning the dry fæces of the bee, and his invention of the Bellows Smoker.

The latest feature that has marked our progress, is the production of comb-foundation in a practical form.

Let us notice for a moment what these changes have done for us in point of production alone.

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*As an expression of Mr. Langstroth's appreciation of Mr. Quinby's work, I give the following, from his writings; "I shall here quote from one of the most common-sense works on practical bee-keeping, which has ever been written in our language. * * * I refer to the 'Mysteries,' etc., by Mr. Quinby. This treatise bears marks, on almost every page, of being the work of an accurate, experienced, and thoroughly honest observer."

I find in an article written by Mr. Quinby, in 1848, for the "Dollar Newspaper," published in Philadelphia, that he takes decided exception to a statement made by another writer, to the effect that he had known 25 lbs. of honey to be gathered by one colony in two weeks.

Mr. Quinby lived to see 57½ lbs. of extracted honey taken from one colony in two days, and 586 lbs. from a stock during the season. He also records a gain of 225 lbs. of box-honey from one colony.

That these results are exceptional, is, of course, admitted, but that they have been reached, indicates the possibilities to which we may yet attain.

A short time before his death, Mr. Quinby remarked that the past five years had shown more progress than the forty years preceding, and he predicted that the five years to come would record even greater advancement. Who shall say that in this he was not correct?

Contemporaneously with these practical achievements, Americans have established a bee-literature which has been a potent agent in disseminating information, and in greatly increasing the number of those engaged in the pursuit.

It would be interesting to be able to furnish correct statistics of bee-culture in the United States. The lists of names in the possession of those who deal largely in bee-keeping supplies, prove that the bee-keepers in this country must be counted by thousands, and the large sales of popular works on the subject are evidence of a constantly growing interest.

The oldest "Bee Journal" in this country was founded in 1861, by Samuel Wagner.

Aside from his ability as a scholarly and practical editor, Mr. Wagner has done apiarians great service through his acquaintance with the best German bee-masters, and his frequent translations from their writings, thus forming a link between the scientists of that country

and the progressive minds of our own. Mr. Quinby much admired Mr. Wagner, and was wont to speak of his services in this direction with marked appreciation. This "American Bee Journal" is now published by Thos. G. Newman, Chicago, Ills., and is the only weekly devoted to this pursuit in this country. It is sustained by an able corps of contributors.

"Gleanings in Bee-Culture," published by A. I. Root, Medina, Ohio, is a semi-monthly periodical, well worthy of the patronage of every enterprising bee-keeper.

"The Bee-keeper's Magazine" is an outcome of "The Bee-keeper's Journal and National Agriculturist," formerly published by H. A. King & Co., and sustains its position creditably among the bee-keepers of the country. It is published by King & Aspinwall, New York City.

"The Bee-keeper's Guide" is published monthly at Kendallville, Ind., by A. G. Hill. It improves each year.

"Kansas Bee-keeper," Scovell & Pond, Columbus, Kansas. This has improved greatly since its first appearance, and now having Mr. Pond as associate editor, it will lose nothing in value or reputation.

We have long felt the need of a bee journal edited by a practical bee-keeper who would, in the broadest sense, publish it in the interest of scientific and practical apiculture; one that was in no way connected with a supply trade, and consequently free to speak of everything used by bee-keepers as the merits demand.

We have had no such journal until the appearance of the "American Apiculturist" in May, 1883, edited and published by S. M. Locke, Salem, Mass. This has more than met the expectations of its friends, and is improving with every number. In many of its features it suits me better than any other journal published in the English language. This continued growth will enable it to become instrumental in elevating this branch of agriculture to a much higher plane than it has ever before occupied.

Of modern books we have yet "Langstroth on the Honey Bee," a work which will never be out of date to those who delight to read of the honey-bee as a Christian gentleman and scholar has delighted to write.

Aside from its practical value, which twenty years have failed to greatly depreciate, its perusal will impress all with a more elevated sense of the wisdom which gave this tiny insect a place in the system of creation.

A recent contribution is the "Manual of the Apiary," by Prof. A. J. Cook, of the State Agricultural College, Lansing, Mich. Prof. Cook is an entomologist, and has opened a field in bee-culture, hitherto comparatively unexplored, in his clear and simple elucidations of the natural history of the honey-bee.

The "New Bee-keeper's Text Book," by A. J. King, is a revision of the old edition, written by N. H. and H. A. King. It is small, compact, and valuable.

"Bee-keeper's Handy Book," by H. Alley, Wenham, Mass. This was published in 1883. It treats largely upon Queen Rearing, in which branch of bee-keeping its author has had twenty-five years' experience. He is one of the best informed bee-keepers in this special direction, and his book should be read by every bee-keeper.

I have recently received a prospectus of a new work called a "Dictionary of Practical Apiculture" by Prof. Phin. I believe that the work will be reliable and of extreme interest, as it treats of a department in bee-culture which has not received much attention.

I must not fail to recognize the aid we have received from foreign writers in their books and periodicals. There are probably no finer, highly-magnified illustrations of the honey-bee, than those found in the "Anatomy and Physiology of the Honey-Bee," by Michel Girdwoyn, published by J. Rothschild, Paris, France.

Mr. Quinby's characteristic benevolence caused him to feel a genuine anxiety that bee-keeping should become a

generally followed pursuit, and those who were familiar with his line of thought, will remember the enthusiasm with which he always encouraged its adoption as a means of increasing the revenues of the country, and at the same time, saving a product that was annually going to waste.

If this work shall, in any degree, carry out his wishes in performing this office, I shall feel amply repaid for the embarrassments under which I have labored, not only in the consciousness of having fulfilled a duty to him to whom I have been under so many obligations, but in the gratification of having, ever so slightly, advanced a calling that is not only honorable and lucrative, but elevating and ennobling.

CHAPTER I.

THE HONEY-BEE.

SIMPLE FACTS IN ITS NATURAL HISTORY.

In its natural state, a colony of bees consists of a queen, several thousand workers and, during a part of the year, a few hundred drones.

THE QUEEN.

The *Queen* is the mother of the entire colony. Her only duty seems to be to lay eggs, of which she sometimes deposits two thousand in twenty-four hours. In shape (fig. 1), she resembles the worker more than the drone, but is longer than either, and, like the worker, possesses a sting, but seldom uses it, except in combat with a rival queen. Her color upon the upper side is darker than that of the others; the two posterior legs and under-side are of a bright copper color. In some queens a yellow

stripe nearly encircles the abdomen at the joints. All the colors are bright and glossy, and she has but little of the down or hair that is seen on the drones and workers. Different queens vary much in color, some being much darker than others. A still greater variation is presented in the Italian queens, most of which are of a rich golden color, while a few are even darker than the usual shade of the natives.

For the first few days after leaving her cell, her size is much less than after she has assumed her maternal duties.

Fig. 1.—QUEEN.

The average age attained by the queen, is about three years. The idea that she governs the colony, and directs all their operations, is probably totally erroneous. They manifest a certain regard and affection for her, however, and a half dozen may often be seen gathered around her, as shown in figure 2. Bees will, when destitute of a queen, continue their labors to some extent, but her presence is necessary to insure their permanent prosperity.

WORKERS.

In size, the workers (fig. 3), are smaller than the queen or drones. Upon them devolves all the labor of the colony. They are provided with a sac or bag for gathering honey, and basket-like cavities on their posterior legs in which to pack the pollen of the flowers in little pellets, for carrying it home to the hive. They range the fields for honey and pollen, secrete wax, construct combs, prepare food to nurse the young, bring water, obtain propolis to seal up all crevices and flaws about the hive, stand guard to keep out intruders, etc.

For the defence of their treasures and themselves, they are provided with a sting and a virulent poison, but will seldom use it when abroad, if unmolested; they volunteer an attack only when near the hive.

This sting, as it appears to the naked eye, is but a tiny instrument of war, so small, indeed, that its wound

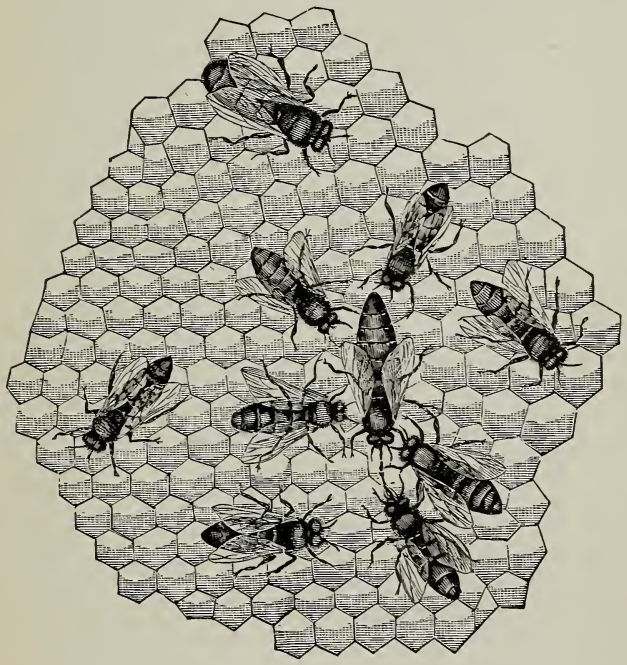


Fig. 2.—A GROUP OF BEES.

would pass unheeded by all the larger animals, were it not for the poison introduced at the same instant. It has been described as being "composed of three parts, a sheath and two darts." The greatly magnified sting and the sac containing the poison are shown in figure 4 on the next page. The darts which penetrate the flesh are close side by side in their sheath or tube below; these darts are also represented at one side and separated to show

Fig. 3—WORKER.

the barbs or small points with which they are furnished. The portions at each side are muscles, etc., which remain attached when the sting is drawn from the bee, as happens when the darts are thrust into the flesh and cannot be withdrawn on account of the barbs; the bee is compelled to leave it behind, and loses its life.

The workers are all females with undeveloped organs of generation, yet they possess enough of the maternal instinct to make them good nurses for the brood of the real mother. For several days after the young worker emerges from its cell, it is almost exclusively engaged within the hive, thereafter it assists in collecting stores.

Fig. 4.—THE STING OF WORKER. *a*, DART.

The life of the worker varies from one to eight months, according to the time at which it is hatched. In the busiest season it lives but a few weeks, but when hatched at the beginning of cool weather, its life is extended through several months.

DRONES.

The *Drones* (fig. 5), are the males; their bodies are large and clumsy, and without the symmetry of the queen and worker. Their buzzing when on the wing, is loud, and different from that of the workers. They have no sting, and may be taken in the fingers with impunity. They seem to be the least valuable class in the bee-community. They assist, sometimes, in keeping up the necessary animal heat in the hive; but one only, out of

thousands, is actually serviceable in fecundating the queen. The number reared depends upon the strength of the colony, and the stores on hand, or being collected.

Fig. 5.—DRONE.

Whenever a scarcity of honey occurs, they are all destroyed. Thus their life is very precarious, being sometimes limited to a few hours, or extended to a few days, weeks, or months; but averaging much less than that of the workers.

CONSTRUCTION OF COMB.

When the flowers expand their delicate petals, and furnish their stores of nectar and pollen, the bees need no stimulus from man to induce them to secure these proffered treasures. Instinct prompts them to collect these stores, and make suitable provision for the rearing of their young.* To this end, comb must be constructed; to produce the materials for this, a large amount of honey is consumed, and by a wonderful process of nature, a secretion of wax takes place, of which the delicate combs are speedily built. (See Chap. XII). The cells of which these combs are composed, are hexagonal in form, and ordinarily of two sizes, adapted respectively to the rearing of workers and of drones. Queen-cells are exceptional in shape and size, and are constructed as needed, with a view to swarming.

GATHERING AND STORING POLLEN.

The pollen of flowers comprises the chief food of the young bees. When collecting it, the bees alight upon the

* The idea is prevalent, that when bees are taken to a warm climate, where they can gather honey during the whole year, they will lose this instinct to accumulate stores, and only provide for their immediate wants. This is an error, as the large quantities of surplus honey stored in such regions, abundantly prove.

flowers, and pass rapidly over the anthers, the pollen-bearing portion of the stamens, detaching a portion of the dust, which lodges on most parts of them, and is brushed together and packed in little pellets in the curious "pollen-baskets" on their posterior legs.

This process is much more readily observed, when the bees are collecting rye-meal, which is sometimes given them as a substitute for pollen. That they gather pollen from but one kind of flower at once, is shown by the uniformity of color in the pellets, pollen from different species, varying greatly in color. It is usually packed in worker-cells, and is generally in the vicinity of the brood-combs, but small portions being often found in other parts of the hive.

It is easy to observe the bees depositing their loads of pollen. The legs holding the pellets are thrust into the cell, and a motion as if rubbing them together is made for half a minute, when they are withdrawn, and the little loaves may be seen at the bottom. This bee appears to take no further care about them, but another will soon come along, enter the cell head first, and pack the pollen close. The cell is filled about two-thirds of its length in this way, and when sealed over, a little honey is used to fill it out. This is undoubtedly done to keep it fresh. The collected pollen is known as "bee-bread."

GATHERING AND STORING HONEY.

The bee gathers honey from the flowers, but does not make it, as is frequently supposed. It is taken into the honey-sac or stomach, and on the return to the hive, is expelled for storage in the cells.

The process of filling cells with honey is curious and instructive. It may be observed by quietly removing the side of a modern hive, when the bees are at work on the outside comb, or by arranging a window in a hive, covered with a door or slide.

The bee goes to the bottom of the cell, deposits a particle of honey, and brushes it into the corners or angles with its tongue, carefully excluding all the air. As it is filled, that nearest the sides of the cells is kept in advance of the center. This is just as a philosopher would say it should be done. If the cell were filled at once, without attaching the honey to the sides, the external air would not keep it in place, as it now does effectually, when the cell is of ordinary length. When the cell is about one-fourth of an inch deep, bees often commence filling it, and as it is lengthened, they continue to add honey, keeping it within an eighth of an inch of the ends. It is never quite full, until nearly sealed over, and often not then. In worker cells the sealing seldom touches the honey.* But in drone cells the case is different; in these, honey at the end touches the sealing about half way up. It is kept in the same concave shape while being filled, but being in a larger cell, the atmospheric pressure is less effectual in keeping it in its place; consequently, when they commence sealing these cells, they begin on the lower side, and finish at the top.

PROPOLIS AND ITS USE.

Propolis is doubtless the gum or resinous coating which protects the buds of many kinds of trees.

It may be found in many species of *Populus*, particularly the Balsam Poplar, (*Populus balsamifera*), and the variety (*candicans*), known as the Balm of Gilead. I have seen the bees collecting it, and have frequently seen them enter the hive with what appeared to be the pure article on their legs, resembling pollen, except that the surface is smooth and glossy. It is of a much lighter color when new, than it is after it gets a little age. I have seen bees when they appeared unable to dislodge the pro-

* This is true only of the native bees.

polis themselves, and were continually running around among those engaged in using it in the hive.

When one required a little, it seized the pellet with its forceps, and detached a portion. The whole lump will not cleave off at once, but firmly adheres to the leg, and from its tenacity, a string an inch long, will sometimes be formed in separating. This substance is used to solder up all the cracks, flaws, and irregularities about the hive. A coat is spread over the inside throughout, and when the hive is full, and many bees cluster outside the latter part of summer, they also spread a coating there. A layer seems to be annually applied, as old hives are coated with a thickness proportionate to their age, provided they have been occupied by a strong family.

In August they use a hundred-fold more propolis than at any time before. Boxes filled in June contain but very little, sometimes none; but when filled in August, the corners, and sometimes the top and sides are well lined. Cracks, large enough for the bees to pass through, are sometimes completely filled with it.

BROOD-REARING.—WHEN IT BEGINS.

The period at which the queen commences depositing her eggs, depends upon the strength of the colony, and the amount of honey on hand. If these conditions are favorable, breeding will take place, to a certain extent, during the winter months, but is not carried on largely until warm weather approaches, and honey is gathered freely.

FORM OF THE BROOD-NEST.

The first eggs are deposited in that part of the comb which is in the center of the cluster of bees and is the warmest part of the hive. A small space is occupied at first, and the cells opposite, in the same comb, are used next.

If there is sufficient warmth in the hive, produced either by warm weather or generated by the bees, the queen will fill a spot on the adjoining combs corresponding with the first, but not quite so large. The circle of eggs in the first comb is then enlarged, and more added to the next, and so on, continuing to spread, and keeping the distance from the center to the outside of the space occupied by eggs about equally on all sides, until they occupy the entire surface of the comb. Long before the outer edge is occupied, the first eggs deposited are matured, and the queen returns to the center, and uses these cells again, but she is not as particular this time to fill so many in exact order as at first, though with the Italian queens, the brood is always very compact.

The rapidity with which this brood-nest is extended, depends upon the supply of food that is being collected, the strength of the colony, and their ability to properly protect and care for the maturing brood.

PROCESS OF EGG-LAYING.

It is very interesting to watch the queen in this operation. I have frequently lifted out a comb on which an Italian queen was engaged in laying, without interrupting her in the least. The light has no immediate effect upon her, as she will quietly continue about her duty, not the least embarrassed by curious eyes.

Before depositing an egg, she enters the cell head first, probably to ascertain if it is in proper condition, as a cell partly filled with pollen or honey, is never used. When it is fit to receive the egg, on withdrawing her head, she immediately curves her abdomen and inserts it. After a few seconds she leaves the cell, when an egg may be seen attached by one end to the bottom. It is about one-sixteenth of an inch in length, slightly curved, very small, nearly uniform the whole length, abruptly rounded

at the ends, semi-transparent, and covered with a very thin and delicate coat, which will often break at the slightest touch.

WHEN THE EGGS HATCH.

After the egg has been in the cell about three days, a small white worm may be seen coiled in the bottom, surrounded by a milk-like substance, which, without doubt, is its food. How this food is prepared, is mere conjecture. The supposition is, that it is chiefly composed of pollen; this is strongly indicated by the quantity which accumulates in hives that lose their queen and rear no brood—that is, when a requisite number of workers is left. The workers may be seen entering the cell every few minutes, probably to supply this food. When the comb is new and white, these operations can be seen more distinctly than when it is old and dark. (Fig. 6.)

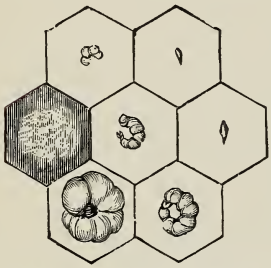


Fig. 6.—EGGS AND LARVÆ.

In about six days after the worm hatches, it is sealed over with a convex waxen lid. It is now hidden from our sight for about twelve days, when it bites off the cover, and comes forth a perfect bee. A very thin silken cocoon remains, which has been spun by the larva. Old combs are sometimes thought to be objectionable, from the accumulation of these cocoons, thereby reducing the cells in size, and diminishing the size of the bees reared in them; but the extreme thinness of the lining deprives this objection of force. The period from the egg to the perfect bee, varies from twenty to twenty-four days, averaging about twenty-one for workers, and twenty-four for drones. The temperature of the hive will vary somewhat

with the atmosphere; it is also governed by the number of bees. A low temperature probably retards the development of brood, while a high one facilitates it.

The young bee, when it first hatches from the egg, is termed a larva; from this state it changes to the shape of the perfect bee, which is said to be three days after finishing the cocoon. From the time of this change, until it is ready to leave the cell, the terms pupa, nymph, and chrysalis, are applied. The lid of the drone cell is rather more convex than that of the worker, and when removed by the young bee in working its way out, is left nearly perfect, being cut off around the edges; a coat or lining of silk keeps it whole. The covering of the worker cell is mostly wax, and is much cut to pieces by the time the bee emerges. The covering to the queen cell is like that of the drone cell, but of greater diameter, and thicker, being lined with a little more silk.

The difference between sealed brood-cells, and honey-cells, is chiefly distinguishable by the darker color of the capping of the former, and their slight depression below the plane of the honey-cells.

At the proper season, when the hive becomes crowded with bees, and honey is plenty, and they are left to the course which their natural instincts dictate, preparations for swarming will commence. One of the first steps is the construction of more or less queen-cells.

THE QUEEN-CELL.

The shape of this cell depends on the position of the comb from which it is made; if, from a comb with cells of ordinary length, they are enlarged, lengthened, and turned downward. If the cells are not very deep, or are near the lower edge of the comb where there is abundant room to turn them down, the enlargement and change of direction will be made very soon after they decide upon making a queen-cell.

Cells that are short, like those on the lower edge of comb not completed, or, on the side, seem to be preferred, and quite a number are often built close together.

When these are one-third or one-half done, the queen will deposit eggs in them.

When hatched, the larva is supplied with a superabundance of food ; this appears from the fact that a quantity is frequently found remaining in the cell after the queen has left. The consistency of this substance is about like cream, the color somewhat lighter, or just tinged with yellow.

The time in which an egg, originally destined for a queen, matures, does not vary much from sixteen days. When some of these young queens are sufficiently advanced to be sealed over, the old queen, and the greater part of the workers, abandon the hive for a new location, (this action is termed "swarming"), leaving those remaining to maintain the prosperity of the old home. The bees after leaving, soon collect in a cluster, and if put in an empty hive, will commence anew their labors, constructing combs, rearing brood, and storing honey ; thus establishing a new colony.

In ordinary circumstances when a swarm has thus left a stock, the oldest of the young queens is ready to issue from her cell in about seven or eight days. When she appears, she will, if not restrained by the bees, at once proceed to bite into the remaining queen-cells and sting the immature queens to death. But if another swarm is not contemplated they will permit her to accomplish their destruction. In three or four days thereafter, if the weather is favorable, the queen will leave the hive for connection with the drone.

In their preliminary preparations for swarming numbers of drones have been reared for this purpose. This meeting takes place high in the air. The queen upon her return frequently bears evident marks of the connec-

tion, and usually begins to lay in three to four days afterwards, and continues throughout the season, unless some special interruption occurs.

Except upon this occasion, and in leading out a swarm, the queen probably never voluntarily leaves the hive.

If, from any cause, the yield of honey fails so far as to make the existence of a swarm in any way hazardous, these preparations are abandoned, and the young queens in all stages, from the egg to maturity, are destroyed.

When this takes place the drones are the next victims. But when this scarcity and consequent destruction do not occur, the drones are spared until later in the season, still they seldom survive the winter. The presence of drones in a hive at an unusual season, indicates the absence or deficiency of a queen.

FACTS AND THEORIES CONCERNING GENERATION.

The theory of partheno-genesis demonstrated by Dzierzon, the able apiarian of Germany, is confirmed by the experiments of Mr. Langstroth and many others. Mr. Langstroth relates some interesting observations, proving that unimpregnated or virgin queens produce drone progeny only, and that queens or workers cannot be reared from such eggs. Dzierzon established the fact that all impregnated eggs produce workers or queens.

Mr. Quinby was not only a diligent student of all the views and experiments of these scientific apiarians, but in his own investigations, was ceaseless in the endeavor to demonstrate the truths which a genuine enthusiasm prompted him to seek.

Many of these facts recorded by other investigators he proved for himself, and during my association with him I assisted him largely in his experiments. That drone-eggs are not affected by the impregnation of the queen,

we clearly demonstrated, as have many others, by the simple test of an Italian queen, fecundated by a native drone, which produced pure Italian drones, and mixed queens and workers. Also, when a native queen meets an Italian drone, the result is similar; the drones are pure natives, and the others of mixed blood.

These facts being determined, it is easy to understand how the eggs of an unimpregnated queen, will produce drones in whatever cells they may be deposited. The fertilization of the queen fills the spermatheca with the seminal fluid, which impregnates a certain portion of the eggs, as they pass from the ovaries, through the oviduct in the process of egg-laying. (Fig. 7).

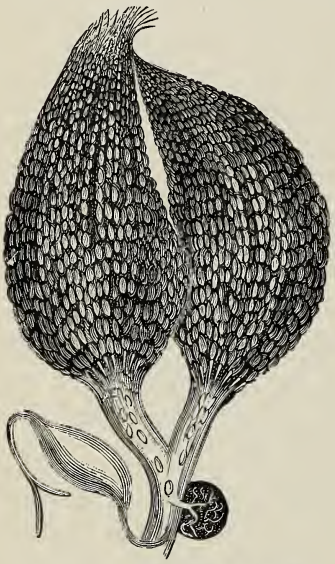


Fig. 7.—OVARIES OF THE QUEEN.

The precise causes which produce the fertilization of this certain portion of eggs, viz., those from which queens and workers are hatched, and the non-fertilization of drone-eggs, are yet the basis of some discussion.

Mr. Wagner, the founder of the American Bee Journal, advocated the theory that fertilization was affected by the size of the cells in which the eggs were deposited; the slight compression produced by the small worker cells, being sufficient to force the fluid from the spermatheca as the eggs are laid. Mr. Quinby took this view, all his experience tending to corroborate it. In support of this, he says: "When I first saw the smallest queen that I

ever raised, whose body was even smaller than that of a worker, it occurred to me at once that if she ever laid, it would be a test of this theory. Her body being small, it could not be compressed like that of others, and a large portion of her progeny, would prove to be drones in worker-cells. The result was just what I expected; one half were drones."

Capt. Hetherington vouches for similar experience, and approves of this theory. Prof. Cook, who claims that the fertilizing fluid is forced out at will, by voluntary muscular contraction, presents the opposing statement, that very small queens make no mistakes, and that with no drone-cells, the queen will sometimes lay drone-eggs in worker-cells which will hatch drones, and also that she will, if compelled, reluctantly place worker-eggs in drone-cells.

I have read and re-read this statement to see if I could not find some qualification, that would harmonize it with my own observations, but in this, our experience differs widely. We, (Mr. Quinby and myself,) gave this point a great deal of earnest thought and study. In hundreds of tests and experiments we were never able to detect a single variation in the rule, that a worker or queen would never be hatched from an egg, deposited in a drone-cell of ordinary size and depth. This is corroborated by the fact that when furnishing a strong swarm with none but drone-combs, where their natural instinct would lead them to rear workers, if possible, I have never found workers or queens raised under these circumstances. This conclusion is sustained by some of the best writers of the past and present.

Prof. Cook argues against Mr. Wagner's theory from the fact that fertilized eggs are deposited in queen-cells, which are too large to afford the necesssary compression, and also in unfinished worker-cells whose walls are not sufficiently extended to produce it.

I would suggest as an explanation of this, that where she is not aided by the size of the cell, as in ordinary worker-cells, the shallowness of these unfinished queen and worker-cells affords her room to curve her body, in order to accomplish the desired fertilization.

In reference to this, one fact must be borne in mind, that in all our experience has held good, which is, that an egg is not found to be deposited in a queen-cell after it has been built out to its full length. In my mind this rule is established, (although it is not well to consider these points invariable), that a queen cannot deposit a fertile egg in a full length queen-cell or drone-cell, from the lack of the aid of these requisites to compression.

On the whole, I am inclined to sustain Mr. Wagner's view, to the extent that the size of the worker-cells aids in producing the muscular effort which secures fertilization; and also the idea that in cases where eggs are deposited in incomplete worker or queen-cells, the curving of her body tends to produce the same result.

May not the instance which Prof. Cook cites of a worker-egg being deposited in a drone-cell, be accounted for on the supposition that the egg was laid before the cell was complete?

FERTILE WORKERS.

There are exceptional instances where workers become able to deposit eggs but, like those of the virgin queen, they invariably produce drones.

It may not be very difficult to account for this anomalous production of eggs, if we consider workers to be simply undeveloped females. The deprivation of a queen that always precedes the occurrence, may produce the intense desire for the continued welfare of the colony, which develops their internal structure to a sufficient degree to produce eggs. Mr. Quinby disproved the theory of Huber that they are developed by

being reared in the vicinity of queen-cells, and partaking of a small quantity of royal food; by the fact that he had fertile workers that were taken from a colony that had never reared a queen.

Personally, I have great interest in these physiological investigations, but have preferred to carry out the original design of this book, in dwelling chiefly upon the practical, rather than the theoretical and scientific phases of the subject.

The natural history of the bee has been most ably presented by Prof. Cook, in his "Manual of the Apiary," which I heartily commend to all who are interested in that branch of apiarian science.

CHAPTER II.

ITALIAN BEES.

ITALIAN OR LIGURIAN BEES.

It is only within the past twenty years that American bee-keepers have known of the existence of any other than our native, or dark-colored, bees. Classical scholars familiar with Aristotle and Virgil, have doubtless read of the different varieties described by them, but would scarcely imagine that the beautiful golden bees of Virgil's song have perpetuated their race in such purity, that their descendants are to-day bred as a distinct variety in our apiaries.

Mr. Langstroth, in his valuable treatise, gives much interesting information concerning the cultivation of the Italian bees in Europe, to which I refer those curious upon the subject.

FIRST INTRODUCED IN AMERICA.

Efforts were made to import Italian bees to America in

1855 and 1859, but, I believe, none were successful until 1860, when Mr. Mahan, Mr. S. B. Parsons, and others, first introduced them. They were at once received with very general approbation. In fact, they met with such favor that, until very recently, I have known of but few instances of dissatisfaction.

Nearly every apiarian of note admitted most of the superior qualities claimed for them by German bee-keepers, before their introduction here, and which were afterwards set forth by those who first brought them into notice.

CHARACTERISTICS.

The Italian bees were said to be larger and more beautiful, more prolific, to swarm earlier and oftener, to work earlier and later, and to gather more honey, to work on blossoms that the natives do not, to be less inclined to rob, to defend themselves better, and to be less disposed to sting, besides possessing many minor excellencies.

It speaks well for the judgment of our German friends that, where they claimed so much for these bees, their representations should be so well sustained.

There are parties who have recently gone to the other extreme, and affirm them to be even inferior to our native bees. While the Italians have been domesticated in nearly every part of this country, and the majority of intelligent bee-keepers have become familiar with their habits and qualities, it is nevertheless true that very many are still unacquainted with them.

The history of this race of bees for the past 2,000 years gives us an intelligent idea of their general characteristics, but the authority from which I shall speak with most assurance, is my own personal experience with them during the past ten years, combined with that of Mr. Quinby, who had cultivated them, with the patience and enthusiasm for which he was noted, for fifteen years. He

was among the very first to secure Italian queens; reared from the first imported stock in 1860, and subsequently imported them himself. Probably no other bee-keeper, at that date, took more enthusiastic interest in their cultivation or pursued his experiments with less prejudice for or against them, than Mr. Quinby.

Being associated in business with him for five years, I received the benefit of his most careful experiments and observations.

We bred Italians largely for the trade, for which purpose we had stock that equalled any in America. We also operated for honey, each season, from 200 to 400 colonies comprised of both natives and Italians, as well as hybrids of all grades. If there are any tests to which we did not repeatedly subject them, I am unable to imagine what they may be.

With the benefit of this experience, then, let us consider some of the various excellencies claimed for them.

Larger and More Beautiful.—It is an easily verified fact, first noticed by Dzierzon, that the size of the cells in which Italians and natives are reared, is the same, and it must naturally follow that the bees themselves cannot differ perceptibly in size.

Our attention has been forcibly called to this point, when we have shipped Italian bees to parties who were disappointed because they were not larger; and I have no doubt that they also failed to meet expectations in regard to their boasted superiority in color and beauty. Yet, I consider this point of beauty one to be appreciated. When the young Italians are flying thickly in front of their hive on a sunny day, I pronounce them truly beautiful.

More Prolific.—This I have demonstrated to my satisfaction. The Italian queen deposits her eggs more compactly in the combs than does the native. This is so evident, that I usually have no trouble, when a card of

brood is brought to me, in determining whether the eggs were laid by an Italian or native queen.

Another reason why they are more prolific, is, that they venture out in cool, spring weather, bringing in both water and pollen, when the natives are less energetic. Of this, I shall speak further in connection with other points. If taken from winter quarters too early in spring, their disposition prompts them to great activity, and they venture out and are lost, which accounts for their suffering more largely by wasting in spring, than the natives.

Swarm Earlier and Oftener.—The fact that they are more prolific, indicates that they will become populous earlier in the season, and this being the prime requisite for early swarms, it readily follows that they may be expected to swarm earlier. It is noticeable that, whatever the variety, those that swarm soonest also swarm oftenest. With the present advanced system of management, where swarming is not desired, this tendency is not itself an advantage, but the condition that gives us a large number of bees, is of much importance. We thus secure a large force available when swarming is controlled.

Work Earlier and Later, gather more Honey, and *Work on Blossoms* that the *Natives do not.*—This, doubtless, may be the case at times. We have had Italian swarms fill boxes with white honey, not storing a cell of dark, when, at the same time, the natives were working exclusively on Buckwheat; that plant yields honey only in the early part of the day, and such swarms of Italians will be found at work much more freely in the afternoon than the others.

It is in the nature of the bee that, when honey is abundant, all bees will improve all their time, even frequently leaving the hive so late at night, that they do not return until the next morning, if fortunate enough to do so at all. That Italians do work upon some kinds of blossoms more freely than natives, as upon the Red

Clover, has been confirmed by a variety of testimony. This, may, to some extent, account for the reports we hear of their gathering double as much honey as the natives in the same locality. If only buckwheat honey were accessible, I should expect the natives to gather the most, as they work much better upon it than do the Italians. It is certain that either they do not maintain the standard claimed in this respect, or else they must take some such advantage as above stated. While I confess to a preference for the Italians in this regard, our experience will hardly justify the extreme superiority claimed.

Less Inclined to Rob.—I can hardly imagine how any practical bee-keeper can come to this conclusion. The same characteristics that make them more vigorous in securing stores from other sources, must prompt them to activity, when honey is in any way improperly exposed.

In regard to their propensity to rob, Mr. Quinby says: "Their industry, activity, and keen scent are remarkable, enabling them to find honey where the natives are seldom seen." When feeding rye-flour, it is noticeable that the Italians are first to carry it away with zeal. If this were not true, I should have no faith in the statements in regard to their superiority in early increase, etc. If honey in the comb is exposed, they are the first to find it, and if the comb is new and tender, they will appropriate it, and use it in the construction of their own comb.

Although I have never practised it largely, I find, by experiment, that wax made from waste pieces of comb, may be utilized by melting it, and stirring thoroughly with honey or syrup as it cools; this leaves the wax in particles that may be fed for comb-building. As there are occasionally instances when the Italians are busy upon blossoms which the natives do not frequent, and the latter are, from lack of forage, comparatively idle, they may from this cause, at times, be first to find a weak

swarm and rob it, thus furnishing plausible evidence in favor of the better habits of the Italians.

Defend Themselves Better.—Here I apply the same test of determination and vigor, and endorse the superiority claimed for them in this particular. I have frequently observed them, as they alighted near the entrance of a hive of natives, and in almost every instance escaped, after being seized by those belonging there, and I have as often seen the reverse occur, when the natives trespassed upon the premises of the Italians. When detected, they were seized, and in nearly every case stung to death. The Italians seem to be more constantly on the watch, and more swift to discern the approach of an enemy. I find that a much smaller swarm of Italians than of natives, may be expected to defend themselves successfully.

Less Inclined to Sting.—The past record of this variety of the honey-bee, represents them as being much more docile, and manifesting far less inclination to sting. This, no doubt, arose from the fact that they had not been so harshly treated as our natives. Our experience confirms the statement, that if an Italian queen is reared from pure stock, and the swarm handled as gently as it should be, from the outset, they will be found pleasant to manage, and less disposed to sting; but if smoked with tobacco, and roughly treated, the energy displayed in other directions is here manifested, and the result will be a larger number of stings, and a worse effect than from the natives.

Hybrids are pronounced by many preferable to either of the pure varieties, and they are unquestionably among the best of honey-gatherers. I much prefer the pure Italians because of their better disposition.

As Box-Honey Workers.—That box-honey usually presents a finer appearance when stored by the natives, I think will be generally conceded. The Italians store the

cells fuller, and cap them over directly against the honey, giving the surface a watery appearance ; while the natives leave a little unfilled place which causes the capping to appear whiter. The difference is so marked that an expert can usually tell, by examining a box of honey, by which variety of bees it was stored. While this peculiarity of the Italians may affect the appearance of box-honey, I conceive that it is an advantage where the honey is stored in combs for winter, as this complete filling of the cells entirely excludes every particle of air.

More Peaceable while being Handled.—That the pure Italians are more agreeable to handle, I believe there is no room to dispute. The search for a queen, will convince the most prejudiced of the truth of this assertion. The Italians, both queen and workers, will remain quietly upon the combs, while the natives are much more easily disturbed.

I prefer the Italians, when extracting, yet the fact that they cling so closely to the comb, is an inconvenience, as it increases the labor of the operation. While the black bees may be nearly all dislodged from the comb by a sudden movement, many of the Italians must be brushed off with a wing.

Moth-Larvæ.—We find Italians much less liable to be injured by the larvæ of the bee-moth, when, from any cause, they become reduced in number. Their superiority to the natives in this respect is well marked, as might be inferred from their energetic nature.

Late Breeding.—It is affirmed that the natives breed later in the fall, and consequently go into winter quarters with more young bees. Let us illustrate with a colony of each variety. Let boxes be placed upon both hives, and furnished so long as the yield of honey continues. As the yield diminishes, it will be found that breeding continues more largely with the natives, and the honey will be stored in the boxes ; while the Italians will fill

the space in the brood-chamber, with stores, earlier in the season, and be much heavier in the fall than the natives. When the honey season is over, we have known native colonies that had stored a goodly amount of honey in boxes, to be entirely without in the brood-chamber.*

This shows why the Italians rear less brood late in the season. It is not that they do not prolong breeding as late as the others, but their space is more limited. We have tested them extensively, when the combs were emptied in extracting, and invariably found them to breed as late and as freely as the natives. A little forethought will easily supply the required conditions, and obviate this cause of complaint.

Longer Life.—If one desires to determine the relative length of life of the two varieties, it may be done by taking a comb of brood that is just beginning to mature, from each of two colonies, Italian and native.

Select such cards as contain nearly equal quantities of brood. Place them in an empty hive with such bees as adhere to them, and leave them to hatch. This should be done when honey is being gathered. If a queen should be reared, she should be removed before depositing any eggs. These bees being so nearly of an age, may be watched as they waste away, and there being no queen to rear more, it may soon be decided which disappear most rapidly. Our experience prove the Italians to be much longer lived.

Color not an Absolute Test of Purity.—As a rule, all other things being equal, the brightest colored queens and drones are to be preferred. Nevertheless, I have had some very fine Italian queens that were quite dark-colored, and I am confident that the very best workers I ever saw, were pure Italian, and yet of a brownish color, with no very distinct bands. I have also had those that were

* I have found it very desirable to take heavy combs from the Italians at such times, and give them to the natives.

particularly bright and yellow, with three distinct bands, which seems to be considered by many the best test of purity, that in other respects showed signs of impurity.

Finally, after candid comparison of the two varieties, I must say that we have obtained the most satisfactory results by keeping both. And this seems to me sufficient proof that neither race monopolizes all the best qualities. It is unquestionable that their relative value will vary in different localities. My advice to all who have not already done so, is to test both sorts for themselves.

How to Procure Italians.—There are many reliable persons engaged in rearing Italians, from whom good stock may be secured. Full swarms may be purchased, or a single queen may be introduced to a colony of native bees. In twenty-one days after her introduction, if fertile, her progeny will begin to appear, and if the change is made in spring, the native bees will usually all disappear during the summer. The details of the process appear in the chapter on Queens.

A queen may be purchased for $2.00, that, in 1860, would have cost $20.00 (the price Mr. Quinby paid for his first queen), and if the investment paid then, as surely was the case, it certainly must do so now.

To those who assert that they can not perceive any superior qualities in the natives, and that they do not want even one swarm, I say, test both kinds side by side, and compare them carefully.

But do not buy Italians as some do, with the expectation that they will of themselves insure success, without intelligent care. They are but valuable assistants. Anything which stimulates active investigation in bee-keepers, brings experience, upon which success must be based.

Cyprians, Syrians, Carniolans, Etc.—Through the efforts of Messrs. D. A. Jones, Frank Benton, and others, who have spent much time and money in this direction, several varieties of bees, new to this country, have been introduced, and their value to some extent tested.

The *Cyprians* have some marked characteristics. They have been quite thoroughly tested, but do not grow in favor with the majority. They are far too irritable to be agreeable to handle. Some consider them superior honey-gatherers. I have given them quite a thorough trial, and the only point I could find in their favor, was a tendency to breed late in the fall, which is desirable as affording a good force of young bees when going into winter quarters. I have not tested the *Syrians*. Mr. Benton pronounces them among the very best. The *Carniolans* are said to possess some very desirable qualities, and a cross between them and the Italians has a good reputation. Much has been said of the *Holy Land* or *Palestine* bees, but my own experience does not corroborate all that is claimed for them.

Mr. Julius Hoffman received an importation of *Caucasian* bees in 1880. He has experimented quite extensively with them, and is of the opinion that they are superior in many respects. In fact, I have never heard more desirable points claimed for any one variety than Mr. Hoffman claims for these. He is one of our most practical bee-keepers, and his conclusions should be received with confidence. Much credit is due those who have been so persevering in securing to us these new varieties. The ultimate results must be of great good, as the future crossing of these different strains will no doubt give us one with a combination of superior traits.

CHAPTER III

SOURCES OF HONEY.

In speaking of the sources from which most of our honey is obtained, I am naturally limited, in a great degree, to the consideration of the honey-producing plants of our northern latitude. Even within a limited area.

the chief yield will be found to be derived from entirely dissimilar sources, and I shall therefore speak in general terms, of those which have come more especially within the range of my own experience.

SOURCES OF POLLEN.

Assuming that bees are not to be taken out of their winter quarters until about the time that the Soft or Red Maple blossoms (for reasons which will appear hereafter), I shall devote but little space to the pollen-producing plants, which appear before that date. Among these early bloomers are Skunk Cabbage (*Symplocarpus fœtidus*), the Alders, (species of *Alnus*), and several species of Willow. The value of the pollen from these earlier blossoms is much diminished now that we feed rye-meal as a substitute for pollen. The feeding of rye-meal has in its favor the fact that bees can work upon it with facility in a sheltered situation, when raw and forbidding weather would prevent their flying any great distance in search of pollen.

The appearance of Soft-Maple blossoms (*Acer rubrum*), indicates that the season is sufficiently advanced to permit the bees to fly with safety. Of course, the date will vary in different seasons and in widely separated sections of country.

When the weather is fine, the yield of pollen from this Maple is usually bountiful, but as is often the case with early blossoms, these are sometimes injured by the frost.

EARLY HONEY PLANTS.

Golden Willow (*Salix alba*, var. *vitellina*), soon follows the Maple, and in favorable weather will afford an abundance of honey of a superior quality.

Gooseberry, Currant, Cherry, Pear, and Peach blossoms each contribute a share of both honey and pollen. Sugar

Maple (*Acer saccharinum*), throws out its thousands of beautiful clusters with a bounteous yield of tempting nectar. The Dandelion (*Taraxacum Dens-leonis*), often proves valuable in affording both pollen and honey.*

About the 20th of May, in this latitude, Apple-blossoms will appear. As these are more abundant than other flowers named, and the season having progressed considerably, a greater gain may be now expected than at

Fig. 8.—WHITE CLOVER.

any previous time. After Apple-blossoms have fallen, there is usually an interval of nearly two weeks before the appearance of White Clover (*Trifolium repens*). In sections where Wild Cherry (*Prunus serotina* and *P. Virginiana*), and Locust (*Robinia Pseudacacia*), abound, this deficiency will be partially supplied. Red Raspberry and White Clover are found in such abundance in many localities, and furnish honey so profusely, that the general

* I have known sufficient honey to be gathered from this plant, to be stored in the combs, quite extensively, and sealed over. This comes at a time when it is a special aid to brood-rearing.

yield will commence with their appearance. The quality of honey from both of these sources is considered to be very superior. Where the Raspberry grows abundantly, bees will be found to frequent it more constantly than they do Clover.

Honey is secreted in the blossoms at all hours, and the bees may be seen working upon them very early in the morning, and to continue the entire day, very often not being interrupted by quite brisk showers. White Clover (fig. 8) remains longer in bloom, and receives more attention after Raspberries disappear.

Fig. 9.—ALSIKE CLOVER.

Much interest has been manifested of late in regard to Alsike Clover (*Trifolium hybridum*, fig. 9). I have furnished the seed to several farmers, that its value might be tested, both as a farm crop and as a source of honey. The hay made from it is fine in quality, being a medium between the coarse Red Clover and the short White Clover. As a honey yielding plant, it is, in my opinion, superior to the White Clover. But experiments indicate that in dry, sandy soils it is not permanent, and will not survive the second winter. It seems to be much better adapted to moist, heavy clay soils, and there is good authority for the statement that it will outlive Red Clover in such localities.

Red Clover probably secretes as much honey as the White, but the tube of the corolla being longer, common bees appear to be unable to reach it. I have seen a few at work upon it, but it appeared to be slow business. The Italians work on it sometimes, apparently out of choice, and often to good advantage.

Sorrel (*Rumex acetosella*), the pest of many farmers, is brought under contribution by the bees, and furnishes pollen in large quantities. Morning is the only part of the day appropriated to its collection.

Fig. 10.—MOTHERWORT.

Catnip (*Nepeta Cataria*), Motherwort (*Leonurus Cardiaca*) (fig. 10), and Hoarhound (*Marrubium vulgare*), put forth their flowers about the middle of June, rich in sweetness, and, as with the Raspberry, the bees visit them at all hours and in nearly all kinds of weather. They remain in bloom from four to six weeks; in a few instances, I have known Catnip to last twelve weeks, yielding honey during the whole time. Mr. Quinby says, "if there is any plant that I would cultivate especially for honey, it would be this."* Borage has been recommended as yielding abundantly, and worthy of cultivation. Ox-Eye Daisy, known as White-Weed in many localities, (*Chrysanthemum Leucanthemum*, or *Leucanthemum vulgare* of some botanical works), a showy flower in pasture and meadow, and worth but little in either, also contains some honey. The flower is compound, and

* My individual experience with these plants, inclines me to give the preference to Motherwort.

each little floret secretes so minute a quantity, that the task of obtaining it is a slow one. It is only visited when more copiously yielding flowers are scarce. Bush Honeysuckle (*Diervilla trifida*), is a particular favorite.

SINGULAR FATALITY ATTENDANT ON SILK-WEED.

Milk-weed or Silk-weed (*Asclepias Corruti*), fig. 11, is another honey-yielding perennial, but a singular fatality

Fig. 11.—MILK-WEED.

befalls many bees while gathering honey from it. Mr. Quinby observed during the period this plant was in bloom, that a number of the bees belonging to hives not full, were unable to ascend the sides to the comb; there would be sometimes thirty or more at the bottom in the morning. On searching for the cause, he found from one to ten, thin, yellow scales, of a long pear-shape, and about the twentieth part of an inch long, attached to their feet. At the small end, was a black, thread-like substance, from a sixteenth

to an eighth of an inch in length; on this stem was a glutinous matter, that firmly adhered to each foot or claw of the bee, preventing it from climbing the sides of the hive. He also found this appendage attached to bees clustered outside of full hives, but it appeared to be no inconvenience to them. Among the scales of wax, and waste matter that accumulate about the swarms to some extent, he found a great many of these scales, which the bees had worked from their feet. The question then arose, were these scales a foreign substance, accidently entangled in their claws, or was it a natural formation? It was soon decided. From the number of bees carrying it, he concluded that if it were the product of any flower, it belonged to a species somewhat abundant. On making a close examination of all such as were in bloom, he found the flowers of the Milk-weed or Silk-weed, sometimes holding a dead bee by the foot, secured by this appendage. The flower has a most singular structure, which could only be explained by means of elaborate magnified engravings; suffice it to say that the appendage which causes so much trouble to the bees, is the pollen of the Silk-weed, which in all the species has a singular form. Instead of being, as is the case in most flowers, a fine dust, the pollen grains are stuck together in little waxy masses or scales, and these are joined in pairs by the thread-like appendage above noticed. These masses are, in the flower, each lodged in a little pouch with only the attachment exposed, and in such a position that the bee, in moving about over the flower, can hardly fail to touch one of them with its foot and pull it out. Were it not for the agency of bees and other insects, the pollen would not be dislodged from these pouches and brought in contact with the pistil of the flower. Other species of Asclepias besides the one mentioned have a similar structure, and no doubt aid in the mischief. When I point out a loss among bees, I would like to give a remedy,

but here I am unable to do so. I am not sure but honey enough is obtained by such bees as escape, to counterbalance the loss.

Whitewood, or Tulip-tree, (*Liriodendron Tulipifera*), yields something eagerly sought for by the bees, but

Fig. 12.—BASSWOOD, OR LINDEN.

whether honey or pollen, or both, I have never ascertained, as it is very scarce in Montgomery, Greene, and Herkimer Counties. Mr. Langstroth speaks of it as "one of the greatest honey-producing trees in the world. As its blossoms expand in succession, new swarms will sometimes fill their hives from this source alone."

Basswood (*Tilia Americana*, fig. 12). This tree is common in the forests of many of our States, and no doubt stands at the head of the list of honey producers. As a shade tree, Basswood, or, as sometimes called, Lin-

den, ranks with the finest. It is hardy and bears transplanting better than many other forest trees. This stately tree, with its graceful clusters of fragrant flowers, adorns village or country grounds, while the soft music of the industrious bee, among the branches, is attractive to the dullest ear. The honey resources of the country might be greatly increased by planting such trees.

Basswood honey is, without doubt, of the most superior quality and flavor. The blossoms are very numerous, and though there are occasionally seasons when they yield but little, the tree is generally a very reliable source of honey. The yield of honey usually continues for about ten days. In localities where the altitude varies from warm valleys to high hills or mountain ranges, the yield will often be extended to two or three weeks.

The largest yield of honey I have ever known in a given time, was from Basswood. I have seen twenty-five pounds gathered in one day by a single swarm, and larger collections are reported by other parties. Of course, such amounts must be secured by the non-swarming plan under the most favorable conditions. In 1874 I commenced with 100 swarms and did not take any surplus honey until Basswood blossomed, July 20th. During the next forty days I secured 10,000 lbs. of surplus, and increased the colonies to 119, giving me an average of 100 lbs. each, from my old stocks. I mention these figures to illustrate the value of this tree for bee-forage. I should here explain that I took advantage of the difference in altitude, and moved a number of colonies six miles to higher ground, where the trees did not come into flower for two weeks after they failed in the valley.

I have never observed such a profuse yield of honey from Basswood, as in that season. The flowers seemed to be dripping with liquid sweetness, and one had but to press them between the fingers to obtain a drop of genuine nectar.

One could easily be pardoned, in even so matter-of-fact a treatise as this, for pausing a moment to contemplate thoughtfully these wonders with which our pursuit so often brings us in contact, that we fail to appreciate their marvellousness. Thousands upon thousands of pounds of sweetness are produced by millions of tender blossoms, and put into our hands, as it were, by a tiny insect, whose life is at the mercy of every passing storm.

Teasel.—In those sections where the Fuller's Teasel (*Dipsacus Fullonum*, fig. 13), is cultivated, the yield of honey is

Fig. 13.—FULLER'S TEASEL.

Fig. 14.—WILD TEASEL.

large and of fine quality. I am indebted to Mr. G. M. Doolittle, of Borodino, N. Y., and Mr. N. N. Betsinger, of Marcellus, N. Y., for facts in regard to the value of Teasel as a source of honey. It is cultivated largely in their vicinity, and their bees profit by it to a considerable extent.

Since becoming familiar with its reputation, I have watched the bloom of the Wild Teasel, (*Dipsacus sylvestris*, fig. 14), but as I never could find the bees upon it, and not being informed as to the different species, I could not understand why so much value should be placed upon it as a honey-yielding blossom. Mr. Doolittle informs me that the Wild Teasel, which has a purple blossom, is seldom, if ever, visited by the bees, but the cultivated

Teasel, with a white blossom, is that from which such bounteous yields are obtained. I quote from an article by Mr. D., in "Gleanings," January, 1878: "The plant is biennial as a rule, although a part of the plants (the smaller ones), may not produce heads until the third year. * * * * * The 'kings,' as they are commonly called, are heads at the top of the stalks, and commence to blossom about July 10th, continuing in bloom about a week or ten days, opening first in the center of the head, blossoming toward the tip and base, and ending off at the base. As soon as the blossoms fall off, the heads are cut, and cured for the purpose of raising the nap on cloth. The 'middlings,' as they are termed, commence to blossom when the 'kings' are about half through, and the 'buttons' come last, making from 20 to 25 days of bloom from the commencing of the 'kings' to the end of the 'buttons.' Bees work on them at all hours of the day, and no matter how well Basswood may yield honey, you will find them at work on the Teasel at all times. I have never known the Teasel to fail to secrete honey except in 1876. The honey is very thin, and much evaporation is required to bring it to the consistency of Basswood honey when first gathered."

Fig. 15.—SMOOTH SUMACH.

Sumach (*Rhus glabra*, fig. 15), is rich in its quality and yield of honey. The shrubs coming into bloom in

succession, the supply is protracted beyond the duration of one set of flowers. Mustard (*Sinapis nigra*), is also a great favorite. Its cultivation is remunerative for its seed alone, and when we add its value to the bees, there seems to be a sufficient inducement to raise it.

I have now mentioned most of the honey-producing plants which bloom before the middle of July. In sections where Buckwheat is not raised, these furnish the principal supply.

Other flowers continue to bloom until cold weather. Where White Clover is abundant, and the fields are used for pasture, it will continue to throw out fresh flowers, sometimes, throughout the entire summer, yet the bees consume about all they collect, in rearing their brood, etc. Thus, it appears, that in some sections, the bees have only about six or eight weeks in which to provide for winter.

LATER HONEY PLANTS.

I will now notice the flowers that appear after the middle of July. The Button-bush (*Cephalanthus occidentalis*) is much frequented for honey; also the Melons, Cucumbers, Squashes, and Pumpkins. The latter are visited only in the morning, and honey is the only thing obtained. Notwithstanding the bee is covered with pollen, it is not kneaded into pellets on its legs. It has been stated that bees get pollen early in the morning, instead of honey. It is not best to always take our word about such matters, but examine for yourselves. Take a look some warm morning, when the Pumpkins are in bloom, and see whether it is honey or pollen of which they are in quest.

Many people seem to think that the vicinity of large flower gardens is of great advantage to their bees, but these are usually of very little value. Mignonette seems to possess some importance when largely cultivated.

The Melilot or Sweet-scented Clover, both yellow and white, deserves a place in our list. It is found in bloom by midsummer, and remains until our latest flowers. Where it grows in profusion, as along many of our small streams, the supply it furnishes is by no means inconsiderable. In color the honey is rather dark, but the flavor is much superior to that of Buckwheat honey.

BUCKWHEAT.

This honey is considered by many to be of inferior quality. Its color, when separated from the comb, resembles molasses of medium shade. The taste is more pungent than that of clover honey; it is particularly prized on that account by some, and disliked by others for the same reason.

In several counties in this State, so little of this grain is raised, that the honey can not be found in the hive or boxes. But in many places it is the main dependence, the bees seldom getting more than a winter supply from the early flowers.

In some sections full sets of boxes are often filled from Buckwheat after a fine yield of white honey. This adds materially to the pecuniary returns from apiaries in such localities. The date of sowing Buckwheat varies with different farmers. I have passed through districts where some fields were out of blossom, while the flowers in others were not yet open, and still others at all intermediate stages. This protracts the yield from this source for several weeks. Although the honey commands a less price in market than lighter grades, it is a source of much profit.

In some regions the Golden Rods, (several species of *Solidago*, fig. 16), afford valuable forage, and assist largely in replenishing the combs for winter consumption. I have frequently observed that bees were working vigor-

ously in early autumn, when it was almost impossible to determine whence they were obtaining their supplies. This suggests the idea that there are many minor sources not noticeable in abundance, which the keen scent of the bees is quick to discover.

Fig. 16.—GOLDEN ROD.

In California, the chief reliance seems to be the "White Sage" (*Eurotia lanata*), of which there are immense quantities. The Cotton of the Southern States is mentioned as valuable. There are many plants peculiar to different localities, upon which more or less dependence can be placed. And, even in those less favored districts where no first-class sources are found, there will always be a moderate gain from the forage of field and forest, which will justify any careful person in keeping a moderate number of colonies, as experience may dictate.

HONEY-DEW.

Honey-dew is found in some localities, but personal ex-

perience will not permit me to speak positively concerning it. Yet, during some of our large harvests of honey, I could easily have believed that the honey was furnished from some hidden source, more abundantly than was possible from the blossoms alone. From information gleaned from various sources, I am inclined to think that leaves may, at times, secrete honey, but it has never been my good fortune to discover it, and Mr. Quinby was alike unfortunate, during two-score years of close observation. It is evidently peculiar to certain localities only. Prof. Cook relates an interesting and convincing case of it, which he observed in California.

DO BEES INJURE GRAIN AND FRUIT?

Many people contend that bees are an injury to Buckwheat, by taking away the substance that would be formed into grain. What are the facts? The flowers open, and honey is secreted. If the bee does not gather it, it is wasted. Now, what is the difference to the plant, whether the honey is lost in this way, or is collected by the bees?

If there is any difference, the advantage appears to be in favor of collection by the bees, for the reason that it thus answers an important end in the economy of nature, consistent with her provisions in ten thousand different ways in adapting means to ends.

Abundant authority may be cited to show that, instead of being a hindrance to the perfect development of grain or fruit, bees are indispensable, in the aid they give in fertilization. Those who have only the most superficial knowledge of plants, are aware that with many, some of the flowers possess only stamens, and others only pistils, and that the pollen from the staminate blossoms is necessary to fertilize the pistillate. This is done in some cases by the wind, which wafts the pollen from the staminate to the pistillate flowers, but in the ma-

jority of such cases, the aid of insects is necessary. In the search for honey, the bees visit numerous flowers of the same species only, in one journey (a fact which is mentioned by Aristotle), and its body being covered by the pollen, it is next to impossible for it not to leave some of it in the proper place.

INJURY TO RIPE FRUIT.

There is a prevalent opinion that bees do much injury to ripe fruit, such as grapes, peaches, plums, etc. It is often affirmed that crops of these fruits, especially grapes, are measurably destroyed by the bees puncturing the skin, and sucking the juices.

A gentleman, whose letter lies before me, states that he does not secure one-twentieth of his grape crop, for this reason.

Mr. Quinby, as well as myself, gave this matter much personal attention, from the fact that we were largely interested in grape culture, as well as bees, having several hundred vines under cultivation. Our experience fully accorded with the testimony of Mr. Langstroth, and other intelligent observers, to the effect that a honey-bee never injures sound fruit. In reply to a gentleman who complained of the bees, Mr. L. gave the following, as among the reasons why the bees could not inflict any extensive injury upon his grapes :

"That as the supplies of honey from the blossoms had entirely failed * * * if the bees had been able to help themselves to his sound grapes they would have entirely devoured the fruit of his vines. * * * That the jaws of the bee being adapted chiefly to the manipulation of wax, were too feeble to enable it readily to puncture the skin, even of his most delicate grapes. In reply to these arguments, being invited to go to his vines and see the depredators in the very act, the result justified my antici-

pations. Though many bees were seen banqueting on grapes, not one was seen doing any mischief to sound fruit. Grapes which were bruised, or the moist stems, from which grapes had recently been plucked, were covered with bees, while other bees were observed to alight upon bunches, which when found, by careful inspection to be sound, they left with evident disappointment.

"Wasps and hornets, which secrete no wax, being furnished with strong saw-like jaws for cutting the woody fibre with which they build their combs, can easily penetrate the skin of the toughest fruits. While the bees, therefore, appeared to be comparatively innocent, multitudes of these depredators were seen helping themselves to the best of the grapes. * * * After the mischief has been begun by other insects, or wherever a crack or a spot of decay is seen, the honey-bee hastens to help itself. * * * In this way they undoubtedly do some mischief, but before war is declared against them, let every fruit grower inquire, if, on the whole, they are not more useful than injurious."

The honey crop of 1869 being a total failure with us, we had ample opportunity to observe if the bees were inclined to commit any unusual depredations upon the products of our vines, and I must exonerate them from any malicious intent or deed.

It is no uncommon occurrence for bees to frequent cider mills in great numbers, attracted by the juice of the crushed apples. It does not always appear to be attendant upon a scarcity of honey, for they often do not care anything about it, even when otherwise idle. The Hon. Harris Lewis, a prominent agriculturist of this county, who makes vinegar largely, has been known to stop his cider mill to avoid the great destruction of bees incident to the operation of crushing the apples. His sense of justice and consideration for the interests of others, at the sacrifice of his own convenience, is char-

acteristic of a man who deservedly occupies a high position among the farmers of our country.

HOW FAR WILL BEES GO FOR HONEY?

The precise distance that bees will fly in search of forage, I am unable to state. Some consider three miles to be the extreme limit, while others place it as high as twelve miles. The most satisfactory results may be expected, if abundant stores can be found within two miles. It is evident that they will work more freely upon blossoms at some little distance, than when these are very near the apiary. If I were to sow anything with a view to a supply of honey, I should prefer that it should not be in the immediate vicinity of the hives.

Their flights are evidently modified by local conditions. During the large yield from Basswood in 1874, already alluded to, as the blossoms failed in the valley, the bees continued bringing in the same quality of honey, following the Basswood day by day, as it opened on the hills, until the first week in August, when they still came in heavily loaded, but very tired from a long flight.

I drove to the hights, six miles distant, and found that Basswood was there just coming into bloom. I immediately moved 48 swarms to this location, and in the following week, these 48 colonies gave me one ton of surplus honey, while the 71 swarms left at home, did not secure one half that amount, yet they continued working upon the same ground during the entire period.

This is a fine illustration of the advantage of obtaining forage within a reasonably short distance. I have never had direct proof to the effect, yet there is ground for the belief that, if honey could not be found nearer, bees would fly the distance named, without being gradually led along by newly opening blossoms as in the case mentioned.

BEST SEASON FOR HONEY.

The inquiry is often made, "Which is best for bees, a wet or dry season?" I have studied this point very closely, and have found that a medium between the two extremes produces the most honey. When farmers begin to express fears of a drouth, then is the time, if in the season of flowers, that most honey is usually obtained, but if dry weather is much protracted, the quantity is greatly diminished. Of the two extremes, a very wet season is much the worst.

This latter is evident from the fact that much rain injures the honey, by diluting it, as well as preventing the bees from gathering as much; whereas, when the weather is moderately dry, the bees are at liberty to work freely, and the honey is evaporated, instead of diluted, improving the quality, and rendering it much more desirable for immediate sealing up. There is no question but the value of honey is much affected by these circumstances, unless properly cured. The weight of extracted honey will vary to the extent of over 1 lb. to the gallon, according to the variation in the season.

CHAPTER IV.

THE APIARY.

THE PREPARATION NEEDED.

If one proposes to make bee-keeping his life-pursuit, he will need very different preliminary instruction from one who, as nearly every farmer may well do, proposes to follow it as an adjunct to other occupation, or the amateur, who would keep a few hives for his instruction and amusement. To one, especially a young man, who feels a

preference for, and a personal adaptation to, bee-keeping as an occupation, tc be followed to the exclusion of all others, we would say that he cannot be too thoroughly prepared, not only by reading, but by instruction in the sciences related to the pursuit, and by practical training. In other avocations it is considered necessary to serve an apprenticeship in order to fit one to pursue them profitably, and in no calling are preliminary study and practice more important than in bee-keeping as a profession. Fortunately for those who would qualify themselves for the pursuit, the State Agricultural College, Lansing, Mich., offers special advantages. The department of Entomology and the Apiary in that Institution is in charge of Prof. A. J. Cook, a scientific Entomologist and thorough Apiarian. But the great number, who must make bee-keeping a secondary matter, are not in need of this thorough preparation, and to these it is hoped that this work will prove a sufficient guide. While it aims to give the most approved apiarian practice, it is intended to be so elementary in its teachings as to meet the wants of the novice, as well as those who have already some experience in bee-keeping, and would learn its most profitable methods.

LOCATION.

In selecting a site for an apiary, there are many considerations to be borne in mind, especially if bee-keeping is to be the sole business. The question of very greatest import is that of resources. Study the subject of the best honey-yielding plants and trees, and be sure that you locate within reach of some tolerably reliable source. Another point of much interest is the general contour of the country. To illustrate. I reside in a valley where Basswood begins to blossom about the 15th of July. If the surrounding country were level, this bloom would last but 12 or 15 days, but being at the foot of a hill, where

in a distance of six miles there is a rise of 600 feet, we find that bees continue working upon it for twice that length of time.

The same is true of the Apple, the Raspberry, and, in fact, all other blossoms that abound ; I find it profitable to locate an apiary about three miles up this hill, where the bees reach up and down, and thus accomplish even better results than when working from the valley. In addition to this, I have observed that the same class of blossoms yield better on elevated ground, than in lower situations. This is a point in favor of choosing a site in elevated regions. This opinion is corroborated by the experience of Mr. P. H. Elwood, Starkville, N. Y., and that of others.

IMMEDIATE SURROUNDINGS.

A location near ponds, or large bodies of water involves some loss. Strong winds fatigue the bees when on the wing, often causing them to alight in the water, whence it is impossible for them to rise again until wafted ashore, and then, unless in very warm weather, they are often so chilled as to be past recovery.

If possible, the hives should be sheltered from cold, heavy winds. If no natural protection is afforded, a close, high board fence should be put up for the purpose. The saving of bees will pay the expense. During the spring months, the stocks contain fewer bees than at any other season. It is then that a large family is important to keep the brood warm. One bee is of more value then than a dozen in midsummer. When the hive stands in a bleak place, the bees returning with heavy loads in a high wind, are frequently unable to strike the hive, they are blown to the ground, become chilled and die. When protected from winds, the hives may front as may be desired, an east or south exposure is generally preferred.

In building the board fence mentioned, the nails should

not be driven home firmly, but should be so left that they may be easily drawn with a claw-hammer, that more or less of the boards may be removed during the hottest weather, to permit a freer circulation of air.

A consideration worthy of mention, is, that the apiary be conveniently near the house or workshop, where the bee-keeper's eye may be frequently upon it. Although swarming may be largely controlled, swarms may occasionally issue, thus making some attention necessary, and

Fig. 17.—HIVES UPON ROOFS AT ILION, N. Y.

it is otherwise important that such attention be quickly given. The apiary should be well fenced against the intrusion of farm stock, and should be as secluded as possible from all farming operations, as well as not too near the highway.

BEE-KEEPING IN CITIES AND VILLAGES.

A limited number of bees can no doubt be kept in our large cities, if, as is generally the case, forage can be found within a reasonable distance.

If no plot of ground is available, the hives can be set in an upper room, or attic, before an open window. The

observatory hive described in another chapter, would be desirable in such a situation. It is quite common to set the hives upon the roof of a building; Mr. Muth, of Cincinnati, keeps quite a number of colonies upon the roof of his store, with excellent success. The illustration (fig. 17), shows several colonies arranged upon the roof of a piazza and house, in the village of Ilion, N. Y.

ARRANGEMENT OF THE HIVES.

Where a large number of hives is to be kept in one yard, it is desirable to have them in as compact form as practicable, as the movements of the bees can thus be more easily observed, and the buildings or rooms occupied in the necessary operations, will be more accessible from all parts of the apiary. When convenient, I prefer arranging the hives in the form of a square. Where there are but few colonies, of course their disposition is immaterial. If a small building is erected, as it should be, for immediate convenience in practical operations, it should be placed at the center of the apiary, or in the most accessible locality.

Fig. 18 shows the arrangement of my own apiary, with a tight fence in the rear, and this building in the center. The house should be about 8×10 feet, and made perfectly bee-tight. In periods of scarcity, bees are attracted even by the smallest opening, and will be seen vigorously at work, endeavoring to gain admission. It is preferable to cover the bottom of the house with hydraulic cement, instead of ordinary flooring. The door should close with a weight or spring, so that it may never be left open, unless intentionally. Windows should be arranged on opposite sides, to give ample circulation of air, when desired, and the sash made movable or hung with hinges. Lights of glass reaching the entire length of the sash, are best, as in transferring, or like opera-

tions, the bees may be more readily brushed down, than when small panes are used.

For warm weather, close windows will not be comfortable. Wire-cloth screens may be arranged and hung with hinges on the outside. These should be made of stuff at least one inch thick, with the wire-cloth nailed upon both sides. When bees are being handled inside, and honey is scarce, those on the outside will be seen crowding upon

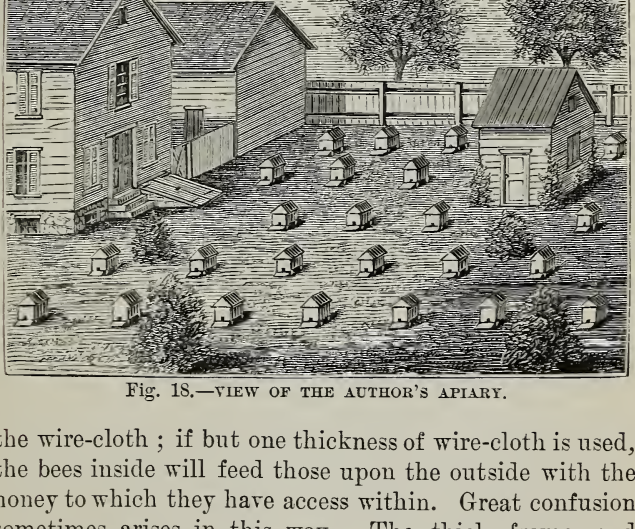


Fig. 18.—VIEW OF THE AUTHOR'S APIARY.

the wire-cloth ; if but one thickness of wire-cloth is used, the bees inside will feed those upon the outside with the honey to which they have access within. Great confusion sometimes arises in this way. The thick frame, and double wire-cloth fully obviates this difficulty. Tight board shutters will be needed to close the windows more thoroughly, when desired.

Convenience should not only be kept in view, but order and neatness as well. Nothing adds more to the attractiveness of an apiary, than a symmetrical disposition of the hives. They should stand in rows in such a manner

that the hives of each alternate row will face the spaces of the row in front of it. (See fig. 18).

The different colored hives or roofs, should be interspersed, so that no two of the same color come next each other. This is particularly important if the hives are necessarily placed rather close together.

DISTANCE BETWEEN HIVES.

The present improved system of management requires that hives should not stand too near each other. There should be at least 6 feet between them, and 10 feet would be a preferable distance. If hives are set this distance apart, queens are less liable to be lost, when returning to the hive after meeting the drones.

The advantage of plenty of room between the hives, is also evident when handling a swarm ; its neighbors will not be so likely to be interrupted, and when using the extractor, it is quite apparent that ample room is essential.

HIVES SHOULD SET LEVEL.

In adjusting the pieces of scantling to be used for stands (as described in Chap. VI.), it is essential that they be perfectly level, at least from side to side. The rear end may be slightly higher than the front, if the combs run from front to rear, and the combs in the boxes run in the same direction.* A quantity of gravel may

* In this connection, I recall an instance of the occupation of combs in an unnatural position, which occurred as follows: I visited an apiary several miles from home, for the purpose of feeding, and took with me a number of combs containing honey. It being too cold to open the hives, I simply removed the packing at the top, and laid the combs flat upon the top of the brood nests, placing panels over them, and replacing the packing. Upon visiting the apiary two weeks later, after the bees had begun gathering honey from apple blossoms, I found that several of these combs had been occupied by the queen, there being sealed brood upon both the upper and under sides; honey was also stored on both sides. The warm position that this comb occupied, was doubtless the cause of the occurrence.

be spread where the hive is to stand, and an accurate level obtained by means of a spirit-level.

Instead of gravel, sawdust has frequently been recommended, and used with satisfaction by some. Others object to it from its liability to take fire. Where the bellows-smoker is used, there is not much force in this objection. If clean gravel can be secured, the whole yard may be covered to advantage, leaving it highest where the hives are to stand. If the gravel is thick enough, and of the right kind, it will pack and prevent grass from growing. If the ground is kept in grass, that should be kept cut short.

DISADVANTAGE OF HIGH STANDS.

When bees come in heavily loaded, towards evening, or on a chilly day, or are driven in by a sudden shower, even if there is no wind, they are very apt to miss the hive, and be unable to gain the entrance, if it is placed at a distance from the ground. On the other hand, if the hive is near the earth, and an alighting board is arranged to reach from the ground to the entrance, they can always creep, long after they are unable to fly, and can thus usually regain the hive, when they can not use their wings. If such facilities are afforded, a large number of bees may be saved.

Belonging to different hives, the loss is often imperceptible, yet the aggregate saving from a large apiary would be of much importance. If any evidence is needed of the truth of this assertion, an examination of the ground about the hives, at night, particularly when a little chilly, will reveal a much greater loss than is generally imagined.

MARKING THE LOCATION.

When bees are first set out in spring, or when moved to a new home, they invariably mark their location. As

they leave the hive, they pause a moment, then rise on the wing, and face it, describing a small circle at first, but increasing as they recede, until an area of several yards has been viewed and marked. After a few excursions, when surrounding objects have become familiar, this precaution is not taken, but they leave in a direct line for their destination, returning by their way-marks without difficulty.

MOVING BEES SHORT DISTANCES.

Very excellent authorities have claimed that bees could not be moved less than a mile and a half or two miles, without injury, as they would return to their former localities. Mr. Quinby says :

"There are a great many people who suppose the bee knows its hive by a kind of instinct, or is attracted towards it, like the steel to the magnet. At least they act as if they thought so, as they often move their bees a few feet or rods, after the location is thus marked, and what is the consequence ?—The stocks are materially injured, and sometimes entirely ruined by loss of bees. Let us notice the cause. As I have stated, the bees have marked the location. They leave the hive without any precaution, as surrounding objects are familiar. They return to their old stand and find no home. If there is more than one stock, and their own has been removed from four to twenty feet, some of the bees may find a hive, but are just as liable to enter the wrong one as the right. Probably they would not go over twenty feet, and very likely not that, unless the new situation was very conspicuous. If a person had but one stock, the loss would probably be less, as every bee finding a hive, would be sure to be right, and none would be killed, as is generally the case, when a few enter a strange hive. Sometimes a stock will allow strange bees to unite with them, but it is seldom, unless a large number enters."

These facts are of value to the beginner, and should be carefully observed, until experience dictates what modifications are allowable. Modern experiments prove that by observing the necessary conditions, bees may be moved short distances without detriment.

I have, in the evening, prepared hives for removal, and taken them, before light the next morning, three miles away, and was positive that not a bee had escaped from the hives. Before noon, quite a number of bees could be seen flying around the stands from which the hives had been removed. I naturally inferred, that these bees had found their way back from the new location. I am now fully convinced that I was in error. These, I think, were bees that had left the hive, so late the night previous, that they were overtaken by darkness, and were unable to reach their home. After becoming sufficiently warm the next morning, they had returned to find themselves homeless.

C. C. Van Deusen, of Sprout Brook, N. Y., purchased several swarms of a neighbor about half a mile distant, and moved them to his own yard, after their lines were thoroughly established at home. Upon releasing them, he smoked them thoroughly, so that all filled themselves completely with honey, and the result was, that the new location was marked, and no bees returned to the former stands.

In 1869 we purchased twenty swarms of bees in box hives and moved them two miles. We afterwards desired to move them half a mile, and did so, but before releasing them, transferred them to movable frames. This operation so thoroughly confused and demoralized them, that this new location was marked, and there was no resulting loss. I have never found it necessary to move bees shorter distances, yet I see no reason why, with the requisite care and skill in manipulation, they may not be moved to as little distance as may be desired, especially,

if so thoroughly disturbed as in the process of transferring. If it becomes necessary to change the location of hives in the same yard, it may be done by moving the hive one or two feet at a time (the distance depending on the contiguity of the adjacent hives), and allowing it to stand a day or two, each time, before moving again. But if the situation of colonies is changed at random, without some intelligent care, much loss will inevitably ensue.

SHADE.

To determine the precise amount of shade which will meet the needs of the entire season, requires some discrimination. Evergreen Trees, Grape Vines, and different varieties of fruit trees, have each their advocates. I have tested the matter very largely, and while I appreciate the benefit of shelter from the sun in exceedingly sultry weather, especially in the middle of the day, I cannot recommend any permanent shade to any great extent. It is very essential, during the early part of the season, that each hive receive the direct rays of the sun during the entire day. If hives can be so arranged among deciduous trees that they may be thus benefited morning and evening, the shade at other hours, during extreme heat, would be desirable.

As a rule, if the roof recommended be so adjusted that the air can circulate between it and the hive, it will afford ample protection. It is my custom, during spring months, to remove these roofs each fair day, and replace them before the dew falls at evening.

Capt. Hetherington, of Cherry Valley, N. Y., apprehending this necessity of warmth, covers the top of the cap with sheet iron, and paints it black. This not only protects the hive, obviating the need of a roof until warmer weather, but being dark, absorbs the rays of the sun, which assists materially in warming the interior of

the hive, and stimulates early breeding at a season when it is of most importance.

It is unquestionable that, in the very hottest weather, the shade of trees would be very grateful and desirable, but, considering the average of cool weather through the season, I conceive it to be detrimental rather than otherwise. In southern latitudes, shade may be more essential.

BEE HOUSES.

Bee houses, as used in times past, have long been condemned as useless and undesirable. When box hives were alone used, and the bees were not manipulated as at the present day, such houses more nearly met the simpler demands of those times; yet even then, the rays of the sun were nearly excluded, with many accompanying disadvantages.

THE HOUSE APIARY.

More recently what is known as the House Apiary (fig. 19), has been devised for movable comb-hives. Mr. Coe, of New Jersey, has designed a form of it, which he claims to possess much merit. One of these was erected at the Centennial Exhibition, and was an object of much interest to apiarian visitors. It may be of any desired size and in shape, square, oblong, hexagonal, or octagonal, as may be preferred. A house 9×15 feet will hold 44 hives, and one 11×34 will contain 100 hives.

It is tightly enclosed on all sides, the hives being arranged on shelves next the walls inside, the bees entering through small openings. It is true that bees may be handled inside of these houses, in rainy weather, or when they would be liable to rob out of doors. One of the benefits claimed is, that swarming may be more easily controlled.

So far as I have investigated the details of construction, I find that the shelves holding the hives are attached to

the sides of the building, thus subjecting the bees to jars caused by the disturbance of any part of it, hence I should not anticipate so good a degree of success as if the hives were disconnected from the building, and each, on its own separate stand, resting firmly on the ground.

The beneficial effects of the heat received by the hives when exposed to the direct rays of the sun, when in the open air, must be supplied artificially within.

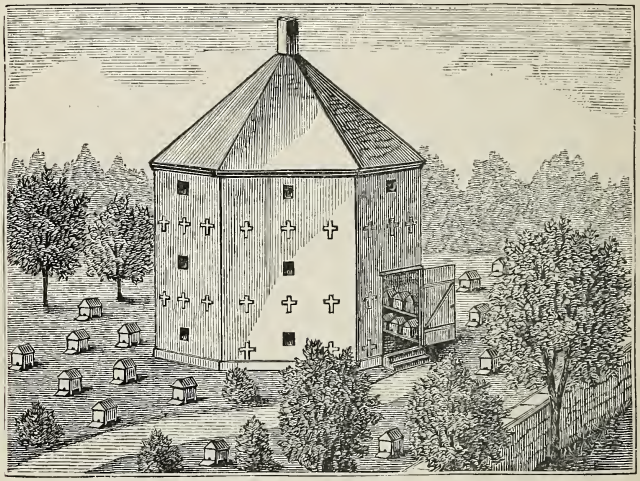


Fig. 19.—HOUSE APIARY OF J. H. NELLIS, CANAJOHARIE, N. Y.

For the information of those who desire to use such artificial heat, I recall a similar experiment. In 1872, while with Mr. Quinby, we demonstrated the fact that we might raise the temperature in and about all parts of the hives, containing strong swarms, yet the bees would not venture to fly, if on reaching the entrance, they found it to be cold without.

The house apiary has been somewhat extensively tested, but evidently it has not as yet reached that point where it may be pronounced a thorough success. I have not

had sufficient experience to warrant the assumption that it may not be very satisfactorily modified and improved, but like many other methods, its merits and deficiencies can only be developed by time and experiment. I favor further trial and investigation.

WHEN TO PURCHASE BEES.

Assuming the location to be determined, and all preliminary arrangements settled, the next important step is, to secure the bees with which to stock the apiary.

After an extended experience in buying bees at different seasons of the year, I shall advise beginners to purchase them only in spring. Those who feel competent to transfer from box-hives to movable combs, should procure them before the first yield of honey in their own location. The inexperienced will, however, find their initiation into bee-culture less perplexing, if able to secure the bees in the kind of movable-comb hive they intend to use.

A marked advantage may be realized by buying bees in a section where the season opens earlier than in that to which they are to be removed. For instance, fruit blossoms are valuable in stimulating early brood-rearing. Buy your bees in a quarter where Apple-trees are going out of bloom just as they are opening in your own, and move them as nearly at this time as possible. A little research on this point will prove advantageous to experienced bee-keepers. A little more care must be exercised in moving bees at such times, as the combs are heavier with brood and honey.

WHERE TO BUY.

This consideration depends upon the variableness of profitable seasons, and also upon the fact that bees will prosper in one locality, and in another at a greater or less distance, do very poorly during the same period.

Other facts in this connection are, that ordinarily, a good season will follow a poor one, and that the best swarms may generally be found in spring, where the previous season was prosperous. The inference is easily drawn, that if we purchase good colonies in such a section, and take them where the approaching season promises well, two essentials will be secured—bees in fine condition and the promise of a good yield.

TRANSPORTATION BENEFICIAL.

It is generally supposed that it is better to secure bees in the immediate vicinity, which is certainly true as regards labor and expense; but experience assures me that when they are properly transported a long distance, there are advantages which offset, partially at least, the extra trouble and cost. With us, such colonies invariably work better than stocks of equal strength of our own wintering, standing in the same apiary. I account for this, in part, from the fact that being supplied with water during confinement and shipment, the bees uncap and dilute their stores of honey, which stimulates the queen to deposit eggs more freely.

Also, the agitation incident to moving them some distance dislodges the moth-worms and the bees may be seen endeavoring to throw them, as well as portions of the worm galleries, from the hive. They are also evidently freed from the more minute pests of the hive in the same manner. Repeated tests convince me of the truth of this assumption. I think this view will yet be developed into practice in the ordinary handling of bees, so that in the proper time and manner they may be excited to more vigorous activity.

HOW TO SELECT SWARMS.

For several reasons, I would advise beginners to purchase swarms at least two years old, especially if to be

transferred. This operation may be more readily performed, and they may be transported with less liability of breaking the combs, and thereby injuring the bees, than if the combs are more new and tender. If such colonies have cast swarms the previous year, which is usually the case, they will contain a young queen; besides, stocks of this age are very apt to be more populous than younger ones.

If good swarms of the previous season can be found in movable comb hives, and are not to be moved a long distance, there will, of course, be no objection to selecting such. Choose hives with straight combs and such as have the most worker comb. The item of the utmost importance at this period is, that they shall be very populous; this is almost positive proof that most of the other desirable conditions are present.

Since the marked diminution of foul brood in this country, the precautions to avoid introducing it, need not be so rigidly observed as was insisted upon in the earlier editions of this work.

COST OF BEES AND FIXTURES.

The cost of a colony of bees will of course vary in different localities. In New York, the price of a good swarm of native bees in a box hive, has been about $5.00, at any season of the year. More recently, good swarms have been sold for $4.00 in the fall, and $5.00 in the spring. This has seemed a fair price when honey realized the better prices that it did a few years ago; but with the present reduction in the price of honey, I anticipate a corresponding decrease in the cost of bees.

Those buying from dealers, where the bees are already in movable frame hives, with straight worker combs, in proper condition, will probably pay $8.00 each, for natives and $10.00 for Italians. Empty hives will cost from $1.00

to $5.00 each. The implements necessary to properly manage an apiary, are an Extractor $10.00, Honey-Knife, $1.00, Wax-Extractor, $5.00, Smoker, $1.50, Bee-Veil, 50c.

There will, naturally, be other minor expenses even in a small apiary. It should be borne in mind that the expense of fixtures is nearly as much for a half a dozen swarms as for an extensive apiary.

TRANSPORTING BEES.

In transporting your bees, avoid, if possible, the two extremes of very cold, or very warm weather. In the latter the combs are so nearly melted, that the weight of the honey will bend them, bursting the cells, spilling the honey and besmearing the bees. In very cold weather, the combs are brittle, and easily detached from the sides of the hive.

Have ready some carpet tacks, and pieces of thin muslin about half a yard square. Invert the hive, put the cloth over, neatly folded and fastened with a tack at the corners, and another in the middle of each side. Drive the tack in about two-thirds of its length ; it is then convenient to pull out when required.

If the bees are to be taken some distance, and must be confined for several days, the muslin will hardly be sufficient, and wire-cloth must be substituted.

To prepare the movable comb-hive for long journeys, put sticks on each side of each comb, in about two places, to hold it steady (see directions for transferring), then lay on the top of the frames, cross-wise, thin strips to hold them in place, and fasten on the honey-board with screws.* Turn the hive over, and cover the bottom with wire-cloth. With proper care they may be sent by railroad one thousand miles.

* If the combs are old, and the distance short, the transferring sticks at the sides of the comb may be omitted.

Probably the best mode of conveyance is in a wagon with elliptic springs. A wagon without springs is bad, especially for young stocks; yet I have known them to be moved safely in this way, with care in packing hay or straw under and around them, and careful driving.

Whatever conveyance is employed, the hive should be inverted. The combs will then rest on the top, and are less liable to break than when right end up, because in the latter case, the whole weight of the combs must come upon the fastenings at the top and sides, and these are easily broken. When bees are moved, thus inverted, they will creep upward; in stocks partly full, they will often nearly all leave the combs, and get upon the covering.

For several years, we have purchased bees largely, bringing them sometimes a distance of 150 miles by rail, when the weather was quite warm. At such times, we used wire-cloth to confine the bees, which was enough larger than the bottom of the hive, to be rounded up, so that the bees could go above the combs, and have a freer circulation of air.

If they are to be shut up any length of time, it is often beneficial to furnish them with water, by sprinkling it through the wire-cloth. They will receive it very greedily. Half a gill may be given each swarm two or three times each day. Or a piece of sponge may be fastened to the wire-cloth, and kept saturated, allowing the bees to take as much as they desire. Much care is necessary in moving heavy colonies in warm weather.

In packing hives into a wagon, place them so that the combs will stand cross-wise of the wagon-box, as they are less liable to break in this position. In a railroad car, they should stand so that the combs will be lengthwise with the car.

In preparing colonies for transportation, it is frequently necessary to work at them during the day, while the bees are flying. All holes in the top of the hive should be

closed, and if there is a hole in front, and the hive is standing near the ground, they may be turned bottom up, and a board set slanting from the ground to the entrance, for the bees to pass in and out. The muslin or wire-cloth may then be put on, and the cap, if any, placed over it, and the usual roof replaced, until they stop flying at night, when the hole at the side should be closed. If there is no hole in front, bore one for the purpose. I often put up large numbers during the day, and move them in the evening or in the following day.

When the bees are brought to the home apiary, they should be smoked to drive them from the wire-cloth, the latter removed, and the hive placed upon the stand it is to occupy.

TAKING BEES ON SHARES.

In managing bees for other parties, as well as in furnishing them to those who wished to care for them, we have usually been governed by the following rule: One party furnishes all the bees, and the other does all the work. All expenses for new material, etc., are shared equally; and the receipts, including the increase, are equally divided. The ownership of the original colonies is unchanged.

FINANCIAL RESULTS.

This is a topic upon which I shall differ widely from many who have represented the interests of bee-keeping. I desire to say very emphatically, that from a thorough knowledge of the business, I must disapprove of the position taken by some in their statements as to the extraordinary returns that may be expected.

A comparison of bee-keeping with other avocations, farming, for instance, will, I think, show a balance of profit in favor of the former. Upon an investment of $1,000 in bees, I should anticipate, with the same amount

of labor, as large an average profit as from $5,000 invested in farming lands, at $100, or more, per acre. This pursuit, therefore, offers evident inducements to persons of moderate means.

Just what annual percentage from a stated investment may be reasonably anticipated, it is impossible to determine, as the seasons are far from being uniform. I shall not encourage beginners to expect an average of 100% upon their investments. Some have represented the prospect as much more alluring than this, but in many cases the returns are likely to prove much less satisfactory. The results attained by the majority of our bee-keepers prove that even my estimate is much too high. Nevertheless, I know of no substantial business that will pay as well for the capital invested, as this of bee-keeping.

OVER-STOCKING.

What number of stocks can be kept in one place? is a question often asked. I shall differ more in opinion with some of our best authors in this, than on most other points. Mr. Langstroth expresses himself, very confidently, that over-stocking has never happened in this country, and that there is no prospect of it. He gives us, on the authority of Mr. Wagner, the number of stocks to the square mile in many sections of Europe. I will give one or two items. In the Kingdom of Hanover, 141 stocks are estimated to the square mile. In the Province of Attica, in Greece, containing 45 square miles, 20,000 hives are kept. A Province in Holland contains 2,000 colonies per square mile.

This is, certainly, very good authority for his conviction, but careful observation and somewhat extended experience will not justify me in accepting Mr. Langstroth's conclusions.

I have endeavored to convince myself that, the large

number of bees kept in and about my own neighborhood, accomplish as desirable results as if the territory were more sparsely occupied. I am thoroughly satisfied that such is not the case.

In the most productive seasons, and during the most ample harvests, the difference is not so perceptible, but under less favorable circumstances, the evidence has been most convincing. We have here, from four to five hundred colonies, working on the same ground. Judging from the results at a yard six miles away, I estimate that if my home apiary of 150 swarms could have the sole range of this region, I should realize an increase of, at least, one-third in my returns. I must maintain then, that there is danger of over-stocking, if we desire to obtain the largest possible yield. These views were held by Mr. Quinby, and were justified by his later experience.

I do not desire to be understood that bees may not be cultivated successfully, even where there are larger numbers than here mentioned, for deficiencies in periods of scarcity may be supplied artificially, but I wish to impress upon the novice who is selecting a site for his apiary, the fact, that the fewer bees in the desired location, the better are his prospects. While reducing to practice many points upon which he is not well informed, he will meet with much less annoyance, if hundreds of swarms are not able to take advantage of any undue exposure of hives or honey, arising from his inexperienced handling.

It will always be impossible to know exactly how many bees can be profitably kept; some seasons yield bounteously, others only partially, and some, almost none at all.

Whoever begins with excessive numbers, must expect to be sometime overtaken with serious disaster. One must lay up a store of fortitude, in prosperous times, to last him through such seasons of discouragement.

It is an advantage to keep as large a number as will

possibly do well in one yard. They may be taken care of with much less proportional expense. It would not do to hire a man to take charge of every eight or ten hives, although the average profit of the few would be much greater than with a large number. One man can manage 100 stocks, except, perhaps, for a few days in the busiest part of the season, and the reduction in the expense would more than balance the larger profits from the smaller apiaries. I would not advise keeping very large apiaries, until warranted by experience in their care. The resources of a country should also be gradually tested. A honey-producing country may be like a grazing region. One field may pasture ten times as many cattle as another, and the same may be true of pasturage for bees.

CHAPTER V.

CONTROLLING BEES.

THEIR DISPOSITION.

Nature has provided the honey-bee with weapons to defend its stores, and combativeness sufficient to use them when necessary. If bees were powerless to repel an enemy, there are a thousand lazy depredators, man not excepted, who would prey upon the fruits of their industry, leaving them to starve. Had it been thus arranged, this industrious insect would probably have long since become extinct. It behooves us, in view of these characteristics, to ascertain what are considered as insults. First, all quick motions about them, such as running, striking, etc., are noticed. If our movements among them are slow, cautious, and respectful, we are often allowed to pass unmolested. Yet the exhalations from some persons appear to be very offensive, as they attack some much

sooner than others, though I apprehend there is not so great a difference as many suppose.* When an attack is made, and a sting follows, the venom thus diffused in the air is perceived by others at some distance, who will immediately approach the scene, and more stings are likely to be received.

The breathing of a person into the hive, or among them when clustered outside, is considered in the tribunals of their insect wisdom, as the greatest indignity. A sudden jar, sometimes made by carelessly moving the hive, is another. After being once thoroughly irritated in this way, they remember it a long time, and are continually on the alert; the moment the hive is touched, they are ready to salute a person's face.

In adjusting the boxes and frames, some of the bees are apt to be crushed, or cut in two. Their surviving comrades are very liable to remember this, and to retaliate as occasion offers.

Bees never make an attack while in quest of honey, or on their return, until they have entered the hive. It is only in the hive and in its vicinity, that we may expect them to manifest this irascible disposition.

I must disagree with any one who says that we always have warning before being stung. Two-thirds of them sting without giving the least intimation. At other times, when fully determined on vengeance, they will strike the hat, and remain a moment endeavoring to effect their object. In this case, one has warning to hold down the face to protect it from a second attempt, which is quite sure to follow. As they fly horizontally, the face held in that position is not so liable to be attacked.

When they are not so thoroughly angry, they often

* Persons using liquor or tobacco, are never successful bee-keepers. I have in mind, a nervous man, who is an inveterate smoker, whose bees are the most pugnacious and unmanageable that I ever saw After purchasing and removing some of these colonies to my own apiary, the difference in temper was perceptible for a long time.

approach in merely a threatening attitude, buzzing around very provokingly for several minutes in close proximity to one's ears and face, apparently to ascertain our intentions. If nothing hostile or displeasing is perceived, they will often leave; but should a quick motion, or disagreeable breath offend them, the dreaded result is not long delayed. Too many people are apt to construe these threatening manifestations into positive intentions to sting. It is always advisable to place the best construction on the action of a bee and act accordingly.

SMOKE, A CONTROLLING AGENT.

The ability to subdue these insects by the use of smoke has been so thoroughly demonstrated that I need say little except as to the mode of applying it. For years Mr. Quinby used partially decayed wood, cut in sticks of suitable size, the smoke of which, when ignited, could be directed to the desired point by blowing with the mouth. Realizing many objections to this process, he expended much time and thought in devising some more safe and efficient method. He had already used a smoker to be held in the mouth, the smoke to be blown among the bees with the breath, but it was unsatisfactory. It was made of a tin tube, two inches in diameter, and six inches long; in one end of this, a short tube of wood was fitted, and in the other end was a longer piece, to hold in the mouth, with a quarter-inch hole bored through each. The fuel was ignited and placed inside, and the smoke blown in the desired direction.

QUINBY SMOKER.

In 1873, Mr. Quinby gave the matter very particular attention, which resulted in the invention of the upright

bellows and tube, which has since been known as the "Quinby Bellows Smoker." This invention I believe all agree to have been original with him. In 1874, it was practically improved and offered to the public.

It has still more recently been much improved in mechanical details, but it is substantially the same in principle, and is, in its present condition, as shown in fig. 20, a popular implement of more than ordinary utility, and is approved by the bee-keeping fraternity generally. Several bellows smokers, differing in some minor details of construction, have been manufactured for sale, but these are based upon the same essential principle, all having adopted the upright bellows and tube. To operate the smoker, light a piece of decayed wood, remove the tapering part of the tube, put in the wood, and replace it. The bellows is worked with one hand, directing the smoke to any point desired. When not in immediate use, it may be placed in an upright position, thereby continuing the combustion as long as required.

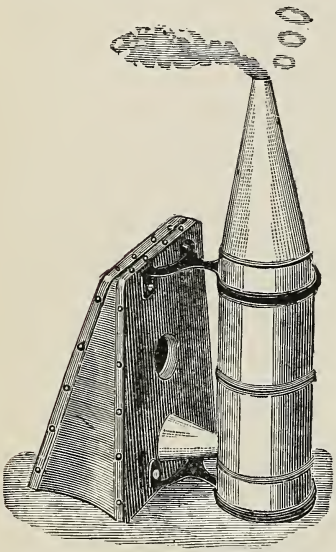


Fig. 20.—IMPROVED QUINBY SMOKER.

DOUBLE BLAST QUINBY SMOKER.

The latest and most valuable improvement in bee-smokers is that by which the draft may be changed at pleasure (see fig. 21). In the single hot-blast smokers the draft passes into the fire tube from the bellows below the

fire. This creates too much fire when working the bellows to force out the smoke; the air blown with the smoke upon the bees is too much heated, and often accompanied with ashes and sparks. To obviate these defects the cold-blast smoker was devised, in which the air enters the fire-tube from the bellows above the fire only. Thus the operator is not able to blow upon the fire directly, to start it, or to free the smoker from ashes.

With the double draft the slide may be shoved so that the draft comes below the fire until it is properly started, or for clearing out the ashes; after which the draft may be reversed and the air taken from above the fire, when it will be cool and free from ashes and sparks. In the largest sized smoker, where the amount of fuel is increased, this feature is particularly valuable. Practical bee-keepers will not be slow to see and appreciate the advantages of this form of smoker. Mr. Quinby had a characteristic dislike of patents, and in accordance with this, he freely gave this valuable aid to bee-keepers, without any of the restrictions which would have proved a protection against piracy, or which would have made it pecuniarily profitable.* With this useful ally, one can perform the various active operations incident to the management of bees, with comparatively little fear of stings. By a judicious use of smoke, at the right moment, their combativeness is subdued and their anger turned to sub-

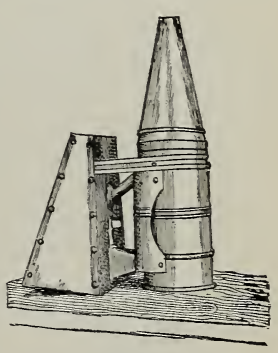


Fig. 21.—DOUBLE BLAST QUINBY SMOKER.

* I have been induced by recent developments, to cover certain improvements in this Smoker by a patent.

mission. Their impulse is, to fill themselves with honey, after which they are more peaceable. There are often occasions when they will require the repeated use of smoke to force them to yield.

MEANS OF PROTECTION.

It has been my effort to show that the fear of stings should be no hindrance to the pursuit of bee culture; yet there are many who will need further protection to insure confidence, especially when handling hybrids. For those who must protect their hands, there is nothing better than long rubber gloves. An over-sleeve of cotton cloth with an elastic in each end to hold it snugly in place, at wrist and elbow, will prevent rambling bees from making explorations inside of one's sleeve.

BEE VEIL.

To guard the face, a veil of mosquito netting, tarlatan, or lace, is sometimes indispensable. A piece a yard and one-quarter by three-quarters or five-eighths of a yard, should be sewed together, with an elastic in one end to be adjusted over the hat crown. Four or five inches from the top insert a piece of coarse-meshed wire cloth of as fine wire as can be obtained. This should be about 6×9 inches. At a suitable distance from the bottom attach a narrow tape to tie about the neck, as shown in fig. 22. Stout, black, bobinet lace, answers an excellent purpose, and is thought by some to be better for the eyes than the wire cloth. A

Fig. 22.—BEE VEIL.

number of veils should always be in readiness, not only for the use of the apiarian and assistants, but for the convenience of visitors who may desire to witness the operations.

SUITABLE DRESS FOR WOMEN.

As women are becoming more and more interested in practical bee-keeping, it may not be amiss to offer a few suggestions as to an appropriate dress for the work. However out of place, long, clinging skirts may be in a kitchen or wash-room, they are doubly so in out-of-door employments.

Many of the operations in the apiary must be performed before the dew has dried in the morning, or soon after a rain, and a long dress becomes damp and draggled. It is also a hindrance to easy and active movements, and as the bees are liable to become entangled in the clothing, the danger of stings is consequently increased. Every woman who wishes to work among bees, should wear a dress suitably short, something like what is called the "American Costume." Drawers should be made of the same material as the dress, tolerably wide, gathered on a band at the bottom, and buttoned tight about the ankle. With sleeves close at the wrist, and veil and gloves, if needed, nothing further can be desired.

INTEREST DISPELS FEAR.

Notwithstanding I have given considerable space to this matter of security from stings, I wish to say that whoever has enthusiasm or interest enough to wish to become a successful bee-keeper, must soon learn to work without fear, and become quite indifferent to special means of protection.

I remember that Mr. Quinby once said of Mr. Langstroth, on the occasion of their first interview, that he

showed the most boldness and indifference to stings of any man he ever saw, and seldom received any. This illustrates the true principle. He was bent on investigation and discovery in his favorite field of study, and the paltry fear of a few stings found no place in his mind. As a natural consequence, the bees took but little notice of him; whereas, if a person passes through the apiary expecting an attack, dodging and evading every bee that flies near him, the bees are quite likely to become displeased and assail him, when he would otherwise have escaped their attention.

REMEDIES FOR STINGS.

It is difficult to tell which are the best remedies for stings. There is so much difference in the effect upon different individuals, and upon different parts of the body, as well as in the depth a sting reaches, that remedies effectual in one instance, will be useless in another.

Ammonia, soda, or salt and soda mixed, and slightly moistened, are probably as efficient as anything. Camphor, taken internally, seems to possess a virtue when the sting is severe enough to cause blotches upon the skin, as well as when applied externally.

When stung in the throat, drinking often of salt and water is said to prevent serious consequences.

Whether any of these remedies are applied or not, it is hardly necessary to say that the sting should be removed as soon as practicable.

In doing this, it should be observed that as the poison sac is yet attached to the sting, it should be extracted in such a way as not to force any more of the poison into the wound. The sting may often be scraped off with a knife-blade, and the part be squeezed a little to force the poison out. It is unquestionable that the system becomes accustomed to the poison in time, and little annoyance is experienced by practical bee-keepers.

CHAPTER VI.

HIVES AND BOXES.

MOVABLE-COMB HIVE.

The movable-comb hive was invented by Rev. L. L. Langstroth, about 1850. The same idea was developed about the same time, but in a less practical form, by Dzierzon, the noted German bee-keeper, whose researches in the natural history of bees, and practical application of the truths he discovered, have won for him the deserved appreciation and admiration of all intelligent bee-keepers.

Mr. Langstroth's invention, however, was of so practical a form as to at once command the approbation of all investigating minds, and speedily wrought a revolution in bee-culture, such as all apiarian history had not before recorded. It is, perhaps, fitting that I should here express my genuine admiration for, and appreciation of the work Mr. Langstroth has done for American bee-keepers. In careful, intelligent study, and insight into the habits of the honey-bee, the clear perception of the best means of adapting the requirements of the apiarian, to their natures ; and in the elegant and scholarly style in which his ideas have been presented to us, he has no superior, and indeed, no equal, in the list of writers on bee-culture. Mr. P. H. Elwood, one of the most scholarly and educated apiarians of my acquaintance, says of Mr. Langstroth's book, that it is one of the most beautifully written works that he ever read on any topic whatever.

CONSTRUCTION AND ADVANTAGES.

For the benefit of that class of bee-keepers who are yet using box hives, and are unfamiliar with the construction

and advantages of movable frames, I will briefly give the most important points. Each comb, instead of being attached to the top and sides of the hive, is built in a frame, so arranged that each can be handled separately.

The hives are so made that all the combs can be inspected without difficulty. When the bees diminish in numbers, the cause can be readily ascertained.

The exact amount of sealed honey can be seen at a glance, and weak colonies strengthened, by exchanging an empty comb, for one full of brood and honey, from a strong colony. The amount of worker-brood that they shall raise may be increased, and the number of drones lessened, by substituting worker for drone comb. Swarms can be made at pleasure by dividing. The ravages of the moth-worm can be detected and prevented.

These are but a few of the considerations hereafter to be presented, but should be sufficient to convince any but the most stolid intellect, of the immeasurable superiority of hives with movable frames, over the common box-hive. Nevertheless, in urging enterprising bee-keepers to adopt them, it must be clearly understood that something is required beyond the mere substitution of a movable-comb hive for the old box.

INTELLIGENT MANIPULATION NECESSARY.

Many bee-keepers have been sadly victimized in their first efforts at such improvement, by the misrepresentations of unscrupulous hive-venders, whose only motive was to obtain the fee for using their "patent" hives, and then leave the perplexed apiarian to blunder into worse dilemmas than before. Many are led to believe that the mere use of the hive in question, will insure the success which the skilled manager of movable frames is able to attain, over the meagre results of the old system.

A hive is procured, but before building a large number,

the purchaser possibly concludes, wisely, to test it before going further.

A swarm is hived in it, and the grand results awaited. By the side of it, stands a box hive, containing a similiar swarm, and if the boxes are well arranged, and the hive smaller than the other, which is usually the case, the chances are that more surplus honey will be stored in them, than in those on the movable-comb hive.

Very often, too, the combs are not built straight in the frames, thus depriving him of the advantages to be gained by handling them. The very natural conclusion of the experimenter, would be, that he was humbugged, and the movable-comb hive was inferior to the box.

Notwithstanding the fact that most writers think it unnecessary to make mention of box hives, the fact that a large number of our bee-keepers still pursue the old method and use them, seems to me a sufficient reason for recognizing them, at least so far as to call their attention to the deficiencies in their system, and to point out to them the benefits to be derived from a change made with due study and attention.

Ever since I have been engaged in bee-culture, I have been under obligations to these box-hive men. We have bought bees largely of them, each spring, to transfer to our hives with movable frames, and thus fill up our stocks to Italianize, and prepare for the following season's operations.

I might occupy much space in describing many hives of much merit, but with an extended knowledge of a very large number, I shall class them under but two heads, Hanging-Frame and Standing-Frame Hives.

THE HANGING-FRAME OR LANGSTROTH HIVE.

In the previous revision of this work, in 1865, Mr. Quinby fully recognized the merits of Mr. Langstroth's

invention, and described the modified form of his hive, which he used successfully for several years.

The simplest form is made as follows:

Cut two pieces $18^{3}/_{4}$ inches long, 12 in. wide, of $^{7}/_{8}$-in. lumber. Rabbet the ends $^{7}/_{8}$ in. wide, and $^{3}/_{8}$ in. deep, to receive the end pieces. This will allow the corners to be nailed from both ways, making it more firm and strong.

Next, cut two pieces $12^{3}/_{4}$ inches long, 12 in. wide, and same thickness.* In one edge of the ends, cut a rabbet $^{1}/_{2}$ in. each way. Nail together with the end pieces inside, and the rabbeting at top, to support the frames. This will make a box $12 \times 12 \times 17$, inside measure. For the bottom board cut a piece $18^{3}/_{4}$ in. long, $13^{3}/_{4}$ in. wide. Cut two cleats $13^{3}/_{4}$ in. long, and $1^{1}/_{2}$ in. square. Nail these on each end, with wrought nails, clinching them firmly. Cut an entrance in this bottom board, 4 in. wide, and $^{3}/_{8}$ in. deep, at the front edge, gradually slanting to the surface, 4 in. back. (See fig. 34). For a top, cut a board of the same size as the bottom. Nail two cleats $12^{3}/_{4}$ in. long, $1^{1}/_{2}$ in. wide, $^{7}/_{8}$ in. thick, across it, 1 in. from the end, and an equal distance from each edge, clinching well. In all cleats it is well to bore holes, for nails, to avoid splitting. It is a mistake of many writers to advise too heavy material for bottom-boards. They should be made light, that they may not add unnecessarily to the weight of the hive when handling. Across the bottom of the hive in the center should be a stick with bent wires, or what is better, a cast-iron piece to hold the frames steady, and at proper distances apart. This (fig. 23) is held in place with screws.

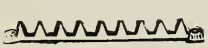


Fig. 23.
IRON FOR FRAMES.

For a cap to cover the top and protect the boxes, cut two pieces $19^{7}/_{8}$ inches long, and wide enough to make suf-

* Unless otherwise specified all material for hives should be ⅞ inch thick.

ficient depth to receive the boxes to be used. Rabbet the corners $^3/_8$ in. $\times\,^7/_8$ in. in the same manner as the sides of the hive. Cut two other pieces, same width, and $13^7/_8$ in. long for ends. Rabbet one corner of each of the four pieces, $^3/_8$ in. each way, so that when nailed together the rabbeting will come on the inside, lower edge. This is to fit the top of the hive and hold the cap in place. A board $19^7/_8 \times 14^7/_8$ nailed upon the top completes the cap.

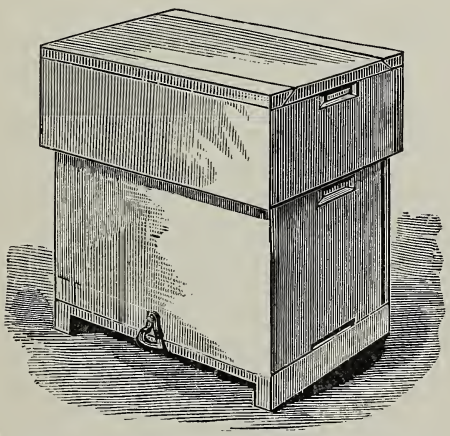


Fig. 24.—HANGING-FRAME, HIVE AND CAP.

A handle for the hive and cap, as shown in fig. 24, may be made by dropping the ends on a wabble saw, or it may be cut with a chisel.

This is the very simplest form of case for a movable frame hive. But it does not meet all the demands of the progressive bee-keeper. Ventilation is to be considered. A hole 5×10 inches may be cut in the center of the bottom-board for this purpose. Two sticks, 12 in. long by $1 \times 1^1/_4$, with a $^1/_4$ in. rabbet in one corner of each, should be nailed across the bottom board at the ends of this hole, in which to slide a ventilator. This should be made of

1/4 in. stuff, and cleated to prevent warping. When it is desired to move bees, or to ventilate them in warm weather, make a frame the size of the ventilator and cover it with wire cloth. One is shown in fig. 34, page 108.

The rabbeting on which the frames rest may be cut 3/4 inch deep, instead of 1/2 in., and a piece of inch hoop iron, nailed or screwed over it, projecting upwards within 1/2 in. of the top, on which the frames may hang instead. There will, in this way, be less bearing, and the frames be less firmly fastened by the bees, thus causing less jar in handling.

FRAMES.

Whatever the size of the frame, there should be but a plain rim around the outside. Frames of all sorts and fashions have been used and recommended, each with some feature designed to meet a special necessity, but the simplest form has long been proved the best. There is probably no point upon which good bee-keepers differ more widely than in regard to the depth of frames.

Some prefer a frame 15 inches deep, while others make them as shallow as six inches. Mr. Bingham uses a standing frame of this depth, for which he claims superior advantages. Mr. Langstroth also recommended a low frame. I prefer a medium between these extremes. Frames should be made of the best quality of lumber, pine to be preferred. A good hanging frame is made as follows: For the top bar, cut a piece 17 3/4 inches long, 1/2 in. thick, and 7/8 in. wide. Cut each end down to 1/4 in. thickness, 7/8 in. from the end. Cut two pieces for the end 11 1/8 in. long,

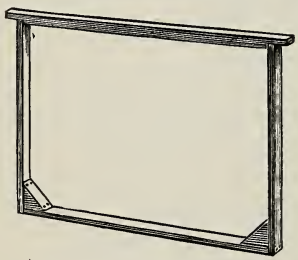


Fig. 25.—HANGING-FRAME.

$^{7}/_{8}$ in. wide, and $^{1}/_{4}$ in. thick. For the bottom, cut a piece 16 in. long, $^{7}/_{8}$ in. wide, and $^{1}/_{4}$ in. thick. Nail together, making a frame as shown in fig. 25. Two triangular blocks should be added to the corners to stiffen the frame. They should be about $1^{1}/_{2}$ in. on the sides next to the frame. Eight of these frames will fill a hive. These hives are designed to receive top-boxes only.

DIVISION-BOARD.

At any time when a limited number of frames is used, the brood chamber should be contracted accordingly. For this purpose, a movable division-board is necessary. If but one or two frames are used for a nucleus, and it is desired that they occupy a position at the center of the hive, a division-board may be placed at each side of the combs. To make one, a board of the required size, with a bar across the top, as shown in fig. 26, is all that is needed. Some cut them slightly smaller than the hive, and place a piece of rubber or leather in a groove around the outside, to fit the sides of the hive more completely.

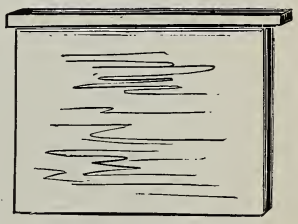


Fig. 26.—DIVISION BOARD.

SIDE-BOXING HIVES.

The question of side-boxing hives occurs here, as their use involves some change in the details of construction. Are they desirable? If honey, rather than increase of colonies is the aim, I answer, yes. Where a moderate increase is preferred, boxes enough to secure all the surplus likely to be gathered, may be used upon the top of the hive, by placing them two tiers high. But if swarming is to be prevented, I consider side-boxes indispensa-

ble, especially in the best seasons. Many of our best bee-keepers are using side-boxes in connection with the hanging-frame hive. This may be done by making the sides of the hive movable, and holding the ends in place, by a piece of hoop-iron, at top and bottom, across each side. The corners may be secured as illustrated, by clasps, such as will be described hereafter. (See fig. 37.)

OBSERVATORY HIVE.

A very convenient form of observatory hive, for the satisfaction of those who wish to observe the operations

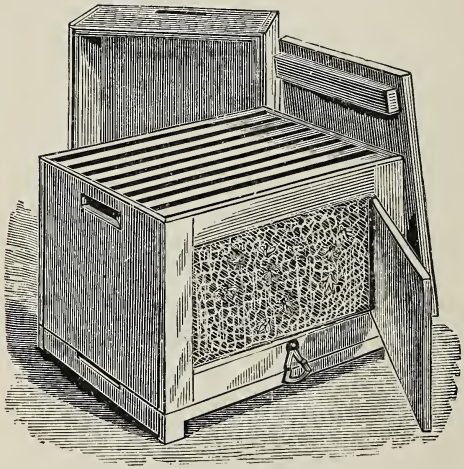


Fig. 27.—OBSERVATORY HIVE.

of the bees, without opening the hive, can be made substantially as the above, except that the two sides should be made with a frame, two inches wide, with a glass fitted in the inside, and a door made of two thicknesses of thin board, with the grain at right angles to prevent warping. This door should fit nicely in the frame, be

hung with hinges, and fastened with a small button or hook. Figure 27, illustrates this hive with a door opened.

THE NEW QUINBY HIVE. (Fig. 28.)

It has already been mentioned, that upon the introduction of the hanging-frame hive, Mr. Quinby at once adopted it, and used it in the form herein described, with

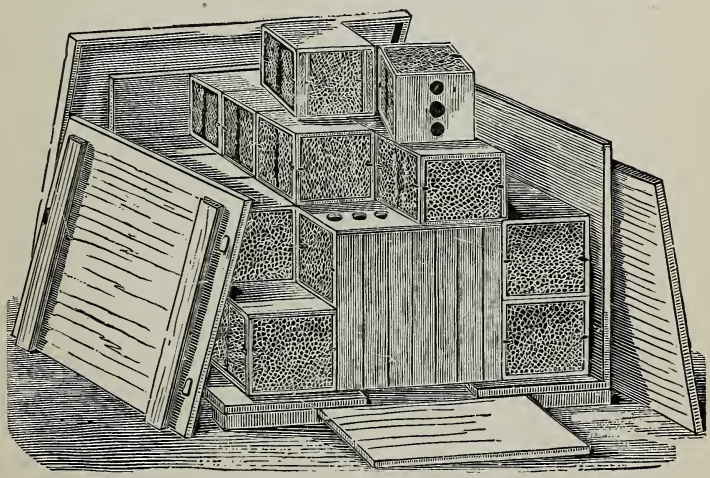


Fig. 28.—QUINBY HIVE, WITH FRAMES AND BOXES.

marked success and satisfaction. It is also well known that the majority of bee-keepers of the present day are using it in some of its forms, with excellent results. The late Adam Grimm, of Jefferson, Wis., used a modification of it, arranged by himself, and known as the Grimm hive, and with it, achieved extraordinary success. This is certainly ample proof of the inherent value of the hanging-frame. Notwithstanding its acknowledged merit, and the results he had attained by its use, Mr. Quinby found, after patient investigation, that there

were yet points in which the hanging-frame hive was deficient, especially when he desired to control swarming. After prolonged study and experiment, he invented, about the year 1868, the "*New Quinby Hive*," with standing frame, and at the time of his death, in 1875, he had so far demonstrated its practicability, and superiority, that it was a source of much gratification.

I designate this as the *New* Quinby hive, from the fact that two other hives have been known as the Quinby hive, viz. ; the box-hive recommended in the first edition of this book, and the modified form of the Langstroth, just described.

The question as to the best size of a hive to meet all the requirements of the advanced bee-keeper, cannot, I maintain, be answered so well with any other hive. The fact is, that with this hive and frame, the size may vary from one frame for queen-rearing, to 16 for extracting, or include any intermediate number, according to the object in view, and in every case, the hive is equally complete and perfect. And I claim it to be indisputable, that for box and extracted honey, wintering, and indeed, in all the facilities it furnishes, the New Quinby hive cannot be surpassed by any hive now in use.

The question may be very properly asked, if this hive is all that I claim, why has it not been more generally adopted ? Those who are familiar with its history since it was first given to the public can readily divine the cause. This, as well as many other meritorious inventions, has suffered materially in reputation by being sent out in a crude, imperfect form, before the details of construction were sufficiently perfected, to commend it to the favor of less patient manipulators. It would be a source of deep regret to me, if even a single person should suppose for a moment, that the new Quinby hive now used by J. E. Hetherington with such flattering success is not an improvement upon those first constructed over ten

years since. If there be any such, they will do well to notice carefully the details of the hive here described, which show its latest improvements. I shall make an especial effort to describe and illustrate it clearly, for in this, as in all points concerned in the revision of this work, I desire to carry out fully the principles of the author, in showing that it is for the public, and not for the sake of personal gain.*

STANDING FRAME.

I propose to describe the standing frame used with this hive, before the case or exterior; from the fact that it is often used independently of the case, which is by some considered the preferable way. To make this frame, cut two pieces for ends, 11 1/2 in. long, 1 1/2 in. wide, and 1/2 in. thick. Cut the top bar 16 in. long, 7/8 in. wide, 1/2 in. thick, and the bottom bar the same length and width, and 3/8 in. thick. Nail together as indicated in figure 29, with the top and bottom strips 1/4 in. from the top and bottom of ends, making a frame 16×10 1/8 inside measure. Corner blocks should be added as in the hanging frame.

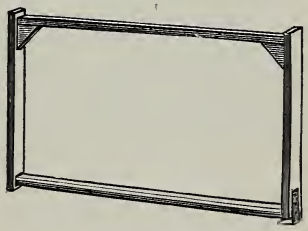


Fig. 29.—STANDING FRAME.

The hook for holding the frame in an upright position is made of 3/4-inch hoop-iron. Cut a piece 2 1/2 in. long, and bend a right angle 3/8 in. from one end. In the long

* It is well known that Mr. Q. had an extreme aversion to patents, and this, as well as many other inventions, was never covered by one. Complaints were made during the past year (1878) that a Mr. Miller, of this State, had secured a patent upon this hive, and was endeavoring to collect a royalty, in some sections. I simply call attention to this, to warn any one using this hive, not to pay any such unjust claim.

end, punch two holes large enough to receive $^{3}/_{4}$-in. clout-nails. This hook is to be nailed on one end of one upright piece, so that the hook or shorter end, will stand directly under the center of the end with a space of a plump $^{1}/_{16}$ in. between it and the end, which gives room to hook it under the hoop-iron on the bottom board, hereafter to be explained (fig. 30). This hook should be nailed on before the frame is put together. O. J. Hetherington makes the hook as wide as the end of the frame, and puts one on each of the four corners. This allows the frame to be reversed if desired. For constructing frames, a form (fig. 31) should be made, by the use of which they may be rapidly and accurately put together.

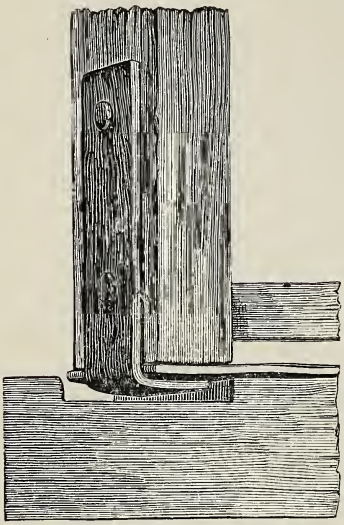


Fig. 30.—HOOK ON END OF FRAME.

PANELS, OR SIDE-BOARDS.

These panels are used at the sides of the frames, and the size of the brood-nest is determined by the number of frames placed between them. The simplest form of a panel

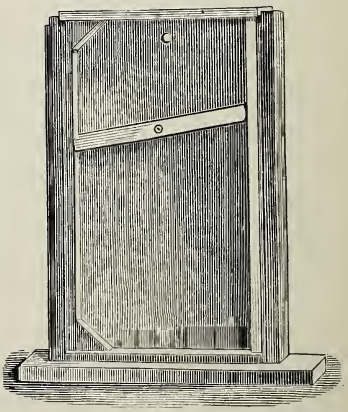


Fig. 31.—FORM FOR BUILDING FRAMES.

is made of pine, by cutting a board 17 in. long, $11^1/_2$ in. wide, and $^1/_2$ in. thick, and cleating with two pieces $11^1/_2$ in. long, $^3/_4$ in. wide, and $^1/_2$ in. thick. Use $1^1/_8$ in. clout-nails (fig. 32). A better form of panel is made by cutting two pieces 17 in. long, 1 in. wide, and $^3/_4$ in. thick, and two other pieces $10^1/_2$ in. long, same width and thickness. In the center of one edge of each of these four pieces cut a groove $^1/_4$ in. wide by $^1/_2$ in. deep. At each end of the two longer pieces, cut away $^1/_2$ in. deep, 1 in. back, to receive the end pieces. This will form a frame $17 \times 11^1/_2$ in. outside. For a panel to fill this frame,

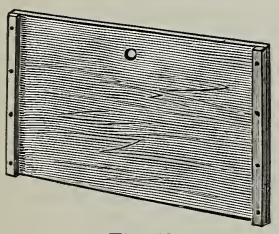


Fig. 32.
PANEL FOR SIDE OF FRAMES.

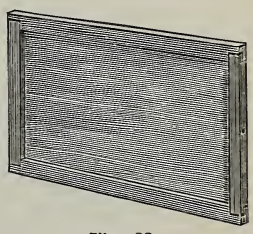


Fig. 33.
PANEL FOR SIDE OF FRAMES.

a board should be cut $15^7/_8$ in. long, $10^7/_8$ in. wide, and $^1/_2$ inch thick. Cut a rabbet all around this $^1/_2$ in. wide and $^1/_4$ in. deep. Place this in the frame, and nail at the corners with $1^1/_2$-in. finishing nails. This gives $^1/_8$ in. margin for swelling (fig. 33). This is generally used with the flat side next to the combs, yet occasionally it will be found very desirable to reverse it when preparing bees for winter, as it will give them needed access to the heavily filled outside combs. The reason for preferring this panel to the first is that it does not vary in width so much by swelling and shrinking, and is not so liable to warp.

SMALL BOTTOM BOARDS FOR QUINBY FRAMES.

These should be, when finished, $18^3/_4$ in. long, and 15 in. wide. Cut two pieces $18^3/_4 \times 5$, and two others, 5×5.

At the end of one of these short pieces, cut two entrances, in the same manner as heretofore directed. The whole width of the piece should be cut away, except $^{3}/_{4}$ in. in the center. Two cleats are needed, 15 in. long, $1^{1}/_{2}$ in. square, and two others, the same length, $1^{1}/_{4} \times {}^{7}/_{8}$ in. Rabbet one corner of each of the last two $^{1}/_{4}$ in. each way, to hold a ventilator. Put the pieces together as indicated in fig. 34, and nail to the cleats, placing the two larger ones at the ends, and the others at the sides of the opening for the ventilator, which may be made as hitherto described.

On the upper surface of this bottom-board, $^{3}/_{8}$ in. from the rear edge, a groove one inch wide and $^{3}/_{32}$ in. deep, should be cut with a dado head, or plane. Over the front edge of this groove nail a strip of 1-in. hoop iron, projecting $^{7}/_{16}$ of an inch over it, using $1^{1}/_{4}$-in. clout nails. The hook on the lower end of the frame hooks under this, and supports the frame in an upright position. A piece of inch hoop iron should be nailed across the front, $^{7}/_{8}$ in. from the edge, upon which the frames may rest, and under which the bees are to pass (fig. 34). Upon this bottom-board, the desired number of frames may be set close together (there being no space between the frames at the ends), a panel placed at each side, and a strong cord tied around all. Place a panel upon the top, and you have a complete hive.

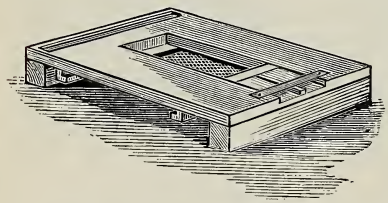


Fig. 34.—SMALL BOTTOM BOARD.

OUTER CASE NOT ALWAYS ESSENTIAL.

I have fully demonstrated in my practice, that for boxing both side and top, the standing frames may be used

with perfect success, without either case, or cap of any kind, when the boxes are enclosed in a clamp, as hereafter indicated. I have operated 100 swarms after this plan, even laying aside cases and caps from choice, in warmest weather. A good roof, to protect the hive from the weather, must be used; this is shown in fig. 39. For protection in cold weather, a simple cap of proper size may

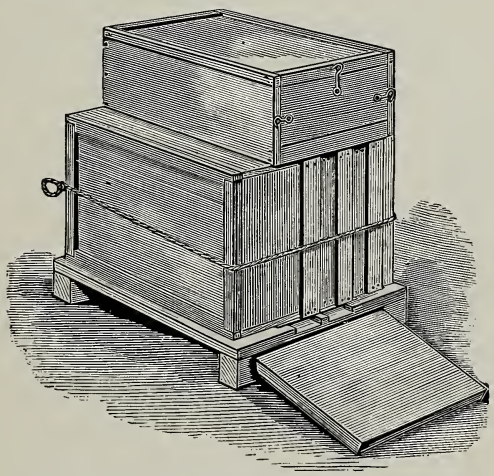


Fig. 35.—QUINBY FRAMES AND BOXES IN CLAMPS.

be made. Let it be well put together. with the top projecting $^1/_2$ in. over, on all sides.

If preferred, this may be placed over the boxes, when they are on the top of the frames.

COMPLETE NEW QUINBY HIVE.

The complete hive, full size, is made as follows: The outer case should be made of 1-in. pine lumber, dressed down on both sides to $^7/_8$ in. thick. The bottom-board is $27^1/_4 \times 18^7/_8$ in. It should be made of matched boards

one-third as wide as the desired length of the bottom-board. Let two pieces be $18^{7}/_{8}$ in. long, and two others 7 in. The cleats should be $1 \times 1^{1}/_{2}$ in., and 2 in. square, respectively, and $27^{1}/_{4}$ in. in length. The ventilator, and support for the frames are arranged precisely as in the small bottom-board.

It would be well to omit cutting the channel over which the hoop iron projects to support the frames, within $^{7}/_{8}$ in. of each edge, which may readily be done when using machinery, but if cut with a hand plane, it must

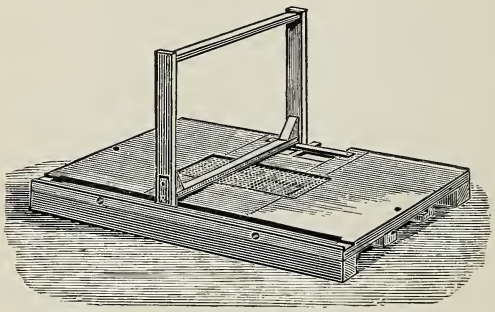


Fig. 36.—LARGE BOTTOM BOARD, WITH FRAME.

be cut through, and the space afterwards carefully filled with wood or leather. Let the hoop-iron come short also, one inch. The entrance should be divided in two parts, as directed. Bore two $^{3}/_{8}$ in. holes, one in the center of each end, to receive dowel pins (fig. 36).

The sides, or front and back, are $27^{1}/_{4}$ in. long, and 18 in. wide. On the inside corners of the ends cut a rabbet $^{3}/_{8}$ in. deep by $^{7}/_{8}$ in. wide, in which to fit the ends, which are $17^{7}/_{8} \times 18$ in.

Both ends and sides should be of matched lumber, as they will be less liable to check than if made of one piece. Each part should be cleated two inches from each end, with cleats 2 in. wide, $^{7}/_{8}$ thick, and 17 in. long. Nail

them on even with the bottom, leaving the space of one inch at top, to receive the lid. In the center of the bottom of the end pieces, put in an iron dowel-pin made of $^1/_4$ in. round iron, long enough to reach into the holes in the bottom-board.

The top, or lid, when completed, should be $29^7/_8 \times 20^3/_4$ in. It is preferable that it consist of three pieces, but two will do. Cut them $29^7/_8$ in. long, and so that they will make a width of 19 in. Two pieces 19 in. long, $1^1/_4$ in. wide, and $^7/_8$ in. thick should be nailed flatwise on the under side at each end. Two other strips $29^7/_8$ in. long, $1^3/_4$ in. wide, by $^7/_8$ in. thick, are to be nailed at the sides, which forms the entire rim of the lid. The corners of the hive are held together by an appliance designed for the purpose by Mr. Quinby, and known as the "Quinby Hive Clasp" (fig. 37). It will be found admirable to use on any hive, as nailing is avoided, and strength and solidity secured. At the same time hives can be readily taken apart for examination, or to pack away when not in use.

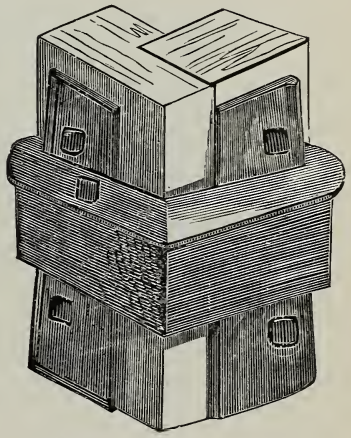


Fig. 37.—QUINBY HIVE CLASP.

With the required number of frames in the center, and space for boxes at sides and top, the hive is now ready to set up (fig. 38).

POSITION OF THE FRAMES.

The question often arises as to whether the frames should stand at right angles to, or parallel with the front

of the hive. The preference of most of our leading bee-keepers seems to be to have them run from front to rear, yet there are good arguments in favor of the other direction. The bees must, of necessity, pass more readily into side boxes with frames from side to side, and the boxes will also receive more uniform warmth from the brood-chamber. Several very practical hives are constructed in

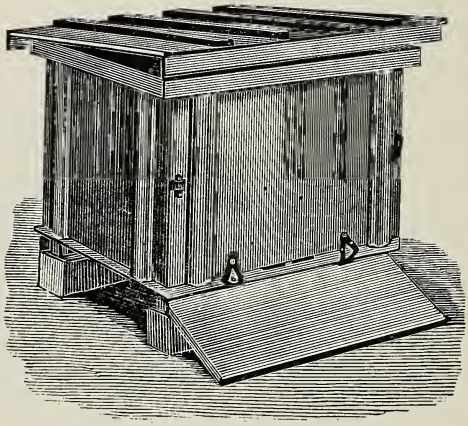


Fig. 38.—QUINBY HIVE, WITH ROOF.

this manner, yet if the frames are short, it will take about one-third more in number to fill the same space, thus increasing the labor when much handling is to be done. Yet, all points well considered, I prefer them the other way.

STANDS FOR HIVES.

The question of stands has been productive of almost as much discussion as that of hives. Every form has been advocated, from those elevated several feet, to those resting directly on the ground; some even going so far as to set their hives close to the earth, without cleats under the bottom-board, and in warm, dry weather, even removing

that, claiming that the cool ground assisted in lowering the temperature of the hive, which is undoubtedly true. As is almost always the case, some good reasons may be presented in favor of each practice. After due experience, I find nothing better than simple pieces of 4×4 scantling, the same length as the cleats of the bottom-board. One of these at front and rear of each hive, will make as good a stand as can be desired.

ALIGHTING BOARDS.

A board one foot wide and as long as the width of the hive, bevelled on one edge, so as to fit snugly below the entrance, and slanting to the ground, makes a good alighting board. It may be hooked to the bottom-board, or a wooden pin may be driven into the ground at the lower edge. Some practical means of assisting the bees to gain the entrance is very essential. (See fig. 38.)

Many extend the bottom-board a few inches in front for this purpose, but I do not regard it with favor, as it occupies more room in winter quarters, and in transportation. It is likewise less convenient to handle.

ROOFS.

A good roof is an absolute necessity. The material should be of good quality. There are two forms of roof which I find suitable and convenient. The size should vary according to the size of the hive, and should project over all sides, at least three inches.

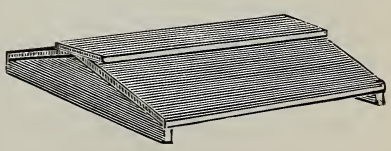


Fig. 39.—ROOF FOR HIVE.

If made according to fig. 38, the pieces on which the boards rest to give the pitch should be just far enough

apart to set over each end of the hive. The lumber should be $^7/_8$ in. thick.

The second form may be made of $^1/_2$ in. boards, fig. 39. In putting roofs together wherever one piece joins another, they should be first painted, and when finished, should receive a good coat of paint, and as often after as may be needed.

PAINTING HIVES.

The principal reason why hives should be painted is, that it gives a cheerful and tidy appearance to the apiary. If hives are well painted it should induce those who are operating with them to handle them with more care. Paint will also assist in preserving hives when exposed to the weather. Nevertheless, painting has its manifest disadvantages. I have always kept both painted and unpainted hives in my apiary, and am fully convinced that the closing of the pores of the wood is frequently very detrimental. I am of the opinion that the rays of the sun are not so readily absorbed, and that moisture is retained, which, without paint, will pass off through the pores of the wood, leaving the interior of the hive in a much more wholesome condition.

In this as in all kindred matters the bee-keeper must make his own experiments, and form his own conclusions. There is less objection to painting the standing-frame hive than some others, as the case or top may at any time be removed without disturbing the brood-nest, and the inside thoroughly warmed and dried; also from the construction of the case there is a better opportunity for the moisture to escape, than where the parts are firmly nailed together. Hives should always be painted as long before using as possible, to free them from any odor, objectionable to the bees, and they should be in light colors.

In view of the frequent exchange of hives in the same apiary, I would suggest that they be painted of some uni-

form shade; and the desired variation in color, which assists the bee in identifying the spot can be secured by different colored roofs, which need not be changed.

ACCURACY ESSENTIAL.

In concluding this topic, let me urge that whatever the form of hive to be used, they be most thoroughly made. It will be noticed that in the dimensions of the New Quinby hive, figures are given as closely as $^1/_{32}$ inch. At first thought, these may seem too minute points for the average bee-keeper to observe. But let me say that this may prove the initial lesson in the necessity for attention to minor details, for it is unquestionable that success in bee-keeping depends upon habits of careful attention to little things. Begin then with thoroughly, and accurately made hives. All hives in the same apiary should be precisely alike, so that all parts are interchangeable. One of the preëminent merits of the movable-comb hive, is in this facility for exchanging combs of honey and brood, for the purpose of equalizing strong and weak colonies.

The most extensive apiarian of this country, J. E. Hetherington, is using 850 of the New Quinby hives, and all are manufactured with admirable accuracy. It is not strange that with this disposition and ability for perfect mechanical work in the construction of his hives and innumerable fixtures, he should reap noticeable success in his favorite pursuit.

Reliable dealers will often furnish bee-hive materials, accurately cut, at much lower rates than a person with less mechanical facilities can prepare them for himself.

HONEY BOXES.

Three important considerations are apparent in determining the kind of box to be used. First, that it is sufficiently practical to meet the wants of the bee-keeper;

second, it must in form and convenience meet the demands of the dealer; and, third, that it present an attractive appearance to the consumer. As there are many forms equally practical for the producer, it remains to inquire what the market demands. This question will be answered variously in different markets.

In New York City, all styles can be sold, from the large wooden box on which tare is allowed, to the dainty one-comb section box now becoming so popular. If a home trade, or local market is to be consulted, a very different box, may, in most cases, be used. Every bee-keeper will decide these questions according to the demand. Whatever the form designed for the grocery trade, it must be one that can be handled without bruising the combs, or injuring the capping, rendering it untidy, and soiling everything with which it comes in contact. The honey trade has already been much injured by the use of an unsuitable box.

SECTION-FRAMES OBJECTIONABLE.

For the past few years, section-frames as used by several leading bee-keepers, have been sold largely through the Mohawk Valley. I have watched the result with much interest. These frames, holding about a pound and a half each, are arranged side by side in rows of 8 or 10, with a glass at the two outer sides. There being no separators between them, the combs are not built true in each frame, but are often attached at the edges to the different frames. In handling and delivering them, the sides are necessarily exposed, and easily bruised; and in retailing, the sections are broken apart, which frequently involves breaking the cells, even when the combs are straight, thus presenting some very objectionable features to the dealer and consumer.

I have seen honey offered for sale in this shape, when it was necessary to set the frames in a shallow dish to catch

the drainage, and any one can easily imagine its sticky, unattractive condition. A customer will often take a number of smaller boxes, in spite of the extra glass, rather than one large one, in order to avoid the leakage caused by removing one comb at a time, as wanted.

It also is open to the very serious objection of attracting marauding bees, as the season of the year precludes their being otherwise busy. I have known grocers to be so seriously annoyed in this way as to be obliged to close their stores. It is very difficult to sell honey to parties who have handled it in such an undesirable shape.

This is a matter of importance. I am not speaking from limited knowledge, but from extensive observation. We must look well to the causes that operate against the sale of honey.

TWO-COMB BOXES.

Very many forms of two-comb boxes have been in use for a long time, with more or less desirable features. I shall describe but one, which recent experience commends as exceedingly practicable. In describing this box, I shall consider the size to be used on the Quinby hive, and weighing 5 lbs. when filled.

The top and bottom are made of pine, $^1/_4$ in. thick, $6^1/_4$ in. long, by $4^1/_4$ in. wide. These are designed to set at right angles to the frames, both at top and sides. Three $1^1/_8$ in. holes are made in the bottom. The posts at each corner are $^3/_8$ in. square, and 5 in. high. This constitutes the entire wood-work of the box. When nailed together, the outside of the posts should stand $^1/_8$ in. in from the corner, so that when packed closely together, there will be less danger of breakage. The glass is held in place by tins, driven diagonally through the center of the post, and clinched, (fig. 40). It will be seen that these tins

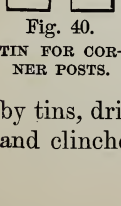


Fig. 40.
TIN FOR CORNER POSTS.

allow the glass to be taken from the sides of the box and returned, even when the box is filled with honey. Glass for the sides is 5×6 inches. If desired to use only top boxes, both end-glasses may be alike, and cut 4×5 inches.

In practice, it will be found that boxes to be used at sides and top, should be exactly alike, as at times it becomes necessary to place those that are partly filled at the sides, on the top to be finished, and vice versa; hence all boxes should have both end and bottom entrance. For this purpose, let one end-glass be cut 2×5 in., and secured at top and bottom with glue. This leaves a space of over $^1/_2$ in. at each side, for an entrance, when

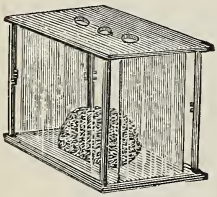


Fig. 41*a*.—TWO-COMB BOX.

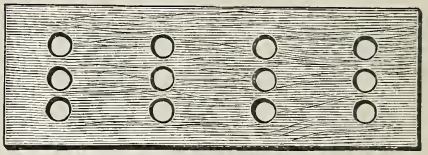


Fig. 41*b*.—HONEY BOARD.

placed at the sides of the combs, and permits a passage from box to box, when these ends are placed together on the top. Guides of clean white comb are indispensable. Holes should be made for nails to prevent splitting. (Fig 41, *a*.)

BLOCK FOR SETTING UP BOXES.

For this, use 1-inch basswood lumber. It is a box 5 in. high and $^1/_4$ in. smaller each way inside, than the outside measure of the honey-box. Before nailing the bottom on the block, saw $^3/_8$ in. from each inside corner outwardly, on an exact mitre. This is to receive the tins that are in the posts. Slight steel-wire springs should be used to hold each post in position until nailed. On the upper edge of each of the four sides, nail a narrow, thin strip $^1/_8$ in. from the inside edge, to hold the bottom of the

box in exact position over the posts, for nailing. This completes the block. The inside of one corner of such a block is shown in fig. 42. Now, to put the box together, place a post in each corner of the block, lay the bottom in place, and nail each corner with inch-finishing nails. If the springs for holding the posts are properly arranged, the four posts may be drawn from the block, by the bottom. To complete the box, an arrangement is used like fig. 43. To make this, take a piece of inch board a foot long, and 8 in. wide, for a base. Near one corner make a standard $5^{5}/_{16}$ in. high, of two pieces 1 in. thick, 4 in. and 2 in. wide respectively. Nail them together at

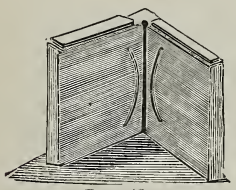


Fig. 42.
BLOCK FOR SETTING UP BOXES.

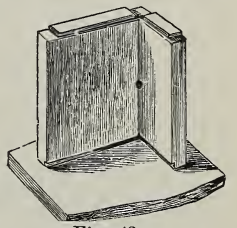


Fig. 43.
STANDARD FOR TOPS OF BOXES.

right angles, after having cut a slot $^{1}/_{8}$ in. deep at the bottom, to receive the bottom of the box. Nail thin strips on the top, the same as on the block. In the center of the corner, bore an inch hole to receive the tin in the post. Lay the box as taken from the block, against this corner, bottom down, place the top on it, and nail each corner. At this point it will be found that the top does not rest snugly against the ends of the posts. It is left $^{1}/_{16}$ in. away, to allow the glass to be more readily put in place. This should now be done, and the glass secured by the tins, bent over each way. The guide combs should be put in before the glass is in place. After all the glass is in, except the narrow end, place the box on a smooth, solid metal surface, and drive the nails snug.

Now, put in the narrow piece with glue, and the box is complete. If the work is properly done in all its parts, this makes a neat, strong, and desirable box.

A honey-board $^1/_4$ in. thick is placed between the boxes and the top of the frames, having holes bored in it, to correspond to the holes in the boxes. (See fig. 41 *b*.) If used at the sides, in the large case, they may be arranged in two rows upon a board the length of the frame, and as wide as the length of the box, with the open end next to the comb.

When the Quinby frames are used without the case, these boxes may be placed at both top and side, by enclosing them in a thin case to exclude the light.

SINGLE COMB, OR SECTION BOXES.

The most popular box of the day is the one-comb, or section-box, varying in size from 4×4 to 6×7; the size most largely used, taking 5×6 glass, and known as the "Prize Box," being $5^1/_4\times6^1/_4$ in. That which I prefer is $5^1/_4$ in. outside measure, taking glass 5×5. In preferring a box of these dimensions, I do not lose sight of the fact that there is a disadvantage in it. Those using a still smaller size should notice these objections. It is well established, that the larger the boxes, the more honey will be proportionally secured. As a rule, I should expect to have as many 5×6 boxes filled in a given time as if they were 5×5. If this be true, we who use the smaller boxes, are losing more in amount than we shall gain in extra prices. The same idea has a bearing upon the thickness of the box. An addition of $^1/_8$ in. to the thickness of a comb would increase the weight very materially, yet it would be filled with very little more labor to the bees, and finished, when fresh boxes added would not be occupied. I have used sections varying in width from $1^3/_4$ in. to $2^1/_2$ in., but have adopted one 2 in. wide, as best suited to my

purpose. One cause of this preference is, that as they are ordinarily filled, I can assort them, in packing for market, in cases of 3, 6, and 12 boxes each, and make them net weights of 5, 10, and 20 lbs. to the case. With me, this is a desirable point. Furthermore, these smaller combs are less liable to break down during transportation than larger and heavier ones.

CONSTRUCTION OF SECTION BOX.

This size may be made by cutting two pieces $^1/_8$ in. thick, $5^1/_4$ in. long, and 2 in. wide; and two more $^1/_4$ in. thick, 5 in. long, and $1^3/_4$ in. wide. This will make a box $5^1/_4$ in. square, (fig. 45). It should be nailed together with $^3/_4$-inch cigar-box nails. The $^1/_8$-in. space on each side of the narrow piece is to receive the glass which is fastened with tin points, cut for the purpose (fig. 44), driven in the wood, and bent down over the edge of the glass. These tin points may either be driven in, and bent down before the boxes are filled, or left until afterwards, if preferred. There is something to recommend each method. It is impracticable to require the bees to fill the sections after they are glassed. In nailing section-boxes together, it will be convenient to use a form for the purpose. By its use each piece is held in its proper position, and the boxes put together very rapidly (fig. 46).

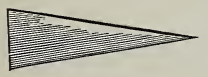


Fig. 44.
TIN POINT FOR HOLDING GLASS.

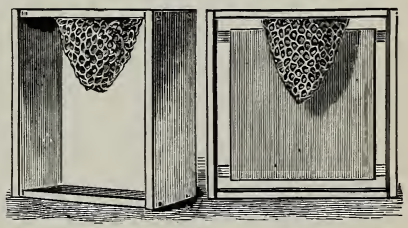


Fig. 45.—SECTION BOXES.

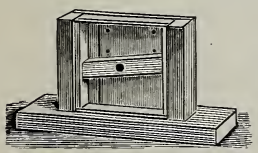


Fig. 46.—FORM FOR MAKING SECTION BOXES.

GUIDE COMBS.

Guides of nice, white comb should be glued in the top of each box, to induce the bees to begin work, as well as to secure straight combs. I find nothing better for this purpose than white glue. Drone comb is preferable to worker comb for guides, from the fact that the bees are more apt to store pollen in worker comb. This is objectionable in itself, and also moth-worms are more likely to infest boxes in which pollen is found. Worker comb, however, usually gives the honey a finer appearance.

SEPARATORS.

The boxes should be arranged in a case, or clamp, with separators or panels between them, to insure the accuracy of the combs, so that they may be glassed readily, after being filled. These separators may be of tin or wood, as preferred. I have used the one I will now describe with success. Cut a piece of $^{3}/_{16}$-in. board $^{5}/_{8}$ in. smaller than the inside measure of the box. In each end, a saw-kerf should be cut $^{3}/_{8}$ in. deep, with a very thin saw. Cut two strips of tin, scant $5^{1}/_{4}$ in. long and $^{3}/_{8}$ in. wide. Fasten these in the saw-kerfs, letting the ends project equally beyond the edges of the panel. Attach separator to box in such a manner that the apertures will be equal at all sides (fig. 47). Only one is used on each box. A cheaper panel, which involves less labor, and works equally well, may be made to reach the width of the clamp, covering two boxes. The length of the panel should be equal to the width of two boxes, and its width should correspond to their hight. It should be $^{3}/_{16}$ in. thick. For an opening for the bees to pass from box to box, cut away the panel, as shown in fig. 48. The aperture should not be

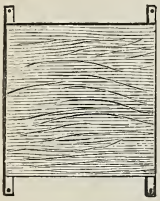


Fig. 47.
SEPARATOR.

more than $^3/_8$ in., measuring from the inside edge of the box. It will be seen that with this arrangement the bees are able to pass in, on but two sides of the panel. This is considered by many to present some advantages. With this panel, each clamp will contain but 14 boxes, while with the preceding one it will hold 16 boxes. I prefer the latter separator, as it enlarges the entrance by spreading the boxes, and I do not consider $^1/_4$ in. between the boxes an ample entrance. It will be seen that by making the panels $^3/_{16}$ in. thick, it gives an opening of $^7/_{16}$ in. Many of our best bee-keepers use only a $^1/_4$ in. entrance, and I should not speak so positively, were it not that I have tested it very thoroughly and proved the superiority of the larger passage. I have arranged the width of box, and separators, with reference to the use of the clamp, at either top or sides, by placing the guides in proper position.

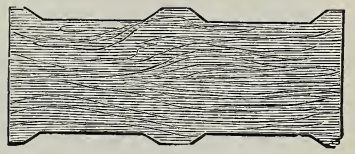


Fig. 48.—SEPARATOR.

THE CLAMP.

This is made by nailing two sides and one end of the right size, substantially, and a strip $^7/_8$ in. deep across the bottom of the other end. The hight should be the same as that of the boxes. Nail a strip of 1-inch hoop-iron lengthwise at each edge of the bottom, and parallel with them; at the center, a piece of

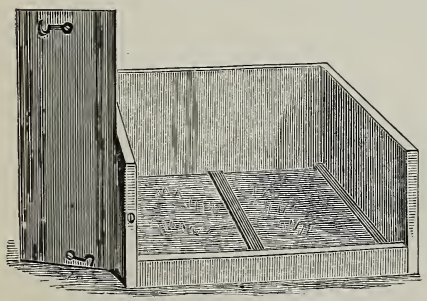


Fig. 49.—EMPTY CLAMP.

1-in. band-iron should be secured at each end with screws. The boxes are to rest upon these irons. A movable piece of board should fit the incomplete end, to be held in place by two hooks (fig. 49). The boxes should be in two rows, with 7 or 8 in each row, according to the panel or separator used (fig. 50). A panel as used at the sides of the frames may be placed over the top of the clamp, and secured by hooks. This manner of arranging boxes in clamps will be found serviceable in many ways. The boxes may be prepared in the winter and packed in them, where they will not be exposed to the light, or in danger of being soiled. When ready to put upon the hives, they are much more expeditiously handled than the large two-comb boxes, which must be adjusted one by one. Boxes at the outside, but partially filled, may be exchanged with those at the center, when all will be completed at nearly the same time. When filled, a large portion may be kept in the clamps, free from dirt and dust, until ready to prepare for market. Side boxes are used by some in the hanging-frame hive, by placing them in a frame, as

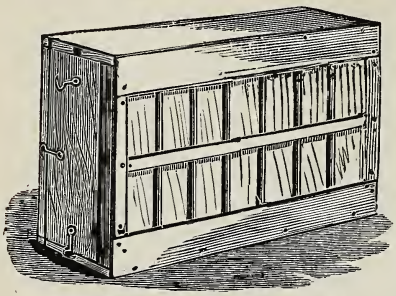


Fig. 50.—CLAMP FILLED WITH BOXES.

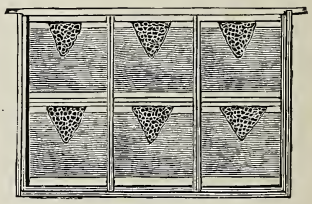


Fig. 51.
FRAME CONTAINING SIX BOXES.

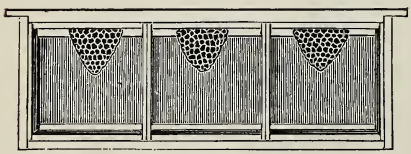


Fig 52.—FRAME CONTAINING THREE BOXES.

shown in fig. 51, and suspending them at the outside of the brood-combs. Others arrange them in a frame, like fig. 52, and suspend them in a clamp on the top.

CHAPTER VII.

TRANSFERRING.

The process of transferring combs from a box-hive to movable frames appears about as formidable to a novice as any of the operations of the apiary. But many obstacles dwindle, and become comparatively insignificant when boldly approached, so a little resolution soon shows the timid apiarian that this is not nearly so serious an undertaking as it appears to be.

ADVANTAGES.

The advantages to be gained do not lie solely in the exchange of a box-hive, for the convenience of movable combs, although that is, of course, the primary object. With the exception of the use of comb foundation, there is probably no other way of securing straight, even worker-combs so satisfactorily as by transferring. The control it gives over the production of useless drones by the rejection of drone-comb is an item of signal importance. The moth-worm may be readily dislodged from any portion of the hives, and combs that are too old, or otherwise objectionable, may be discarded. The mere fact of the change alone often seems to impel the bees to work with greater energy and vigor. By purchasing bees in box-hives, and transferring to movable frames, an apiary can usually be stocked at less expense than if the bees are bought already in movable combs.

TIME TO TRANSFER.

Experience indicates that there is no better time for transferring than just as apple-trees begin to blossom. The benefits derived from the operation, as mentioned above, show that a period when there is the least honey and brood in the combs is naturally the most desirable. As the bees are beginning to gather honey, they are less liable to rob, and the combs are more readily repaired and fastened in the frames. It is practicable at any time when honey is being collected. But the greater the quantity of honey and brood present, the more care is required in the process.

PRELIMINARIES.

Have the following articles in readiness: A transferring board, about the size of the frame, with cleats 2 in. square under each end. Grooves $^1/_2$ in. wide and $^1/_4$ in. deep, should be made at intervals of about 2 inches across the board. Cushion the surfaces between these grooves by tacking on several thicknesses of cloth, to prevent injury to the brood when the comb is laid upon it (fig. 53). Transferring sticks for holding the combs in place should be $^1/_4$ in. square and $^3/_8$ in. longer than the depth of the frame. Fasten two sticks together at one end with a piece of fine, annealed wire, long enough to bring them about one inch apart. Attach a piece of wire to the other end of one of these sticks, leaving one end of

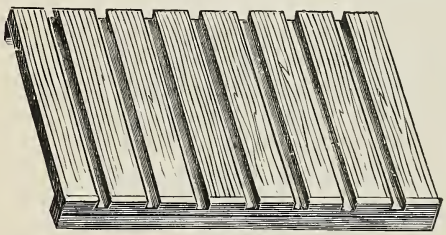


Fig. 53.—TRANSFERRING BOARD.

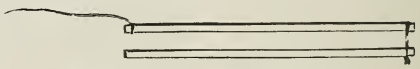


Fig. 54.—TRANSFERRING STICKS.

the wire loose (fig. 54). In this way the sticks are in pairs ready for use.

A smoker, a long, sharp, thin-bladed knife, a chisel, an axe or hatchet, a small common hand-saw, a small wing, and a dish of water, will complete the outfit.

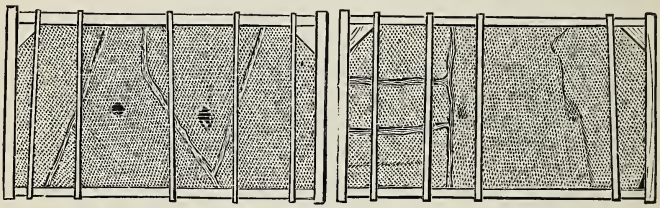
PROCESS.

The operation should be performed in a room with all the windows but one darkened. The hive to which the bees are to be transferred should be placed under this window in such a position that the bees may be readily brushed into it at the close of the operation.

After smoking the bees slightly, turn the hive bottom up and place an empty box over it the same size as the hive. By tapping the hive gently, most of the bees will leave it and enter the box above. When most of the bees are in the box, place it upon the old stand, raising it a little in front for the passage of the bees, and remove the hive containing the combs to the room selected. Place the hive bottom up on a solid block, or other support, about two feet high. Saw the combs and cross-sticks loose from the side, or sides, you desire to remove.

If the combs stand parallel with the sides, it will often only be necessary to remove one side, but if they are diagonal two sides will need to be taken off. If the grain of the wood runs up and down, split the sides in several places and take out the pieces separately, but if the grain runs across, pry them off with a chisel. During all operations use care not to crush any bees remaining in the hive. Upon a table or bench near by, place the transferring-board. Now, with the knife, remove the outside combs, brush off the bees with a wing and set them one side until you come to one containing brood. Place this upon the board described, so that it will occupy the same position as it did in the hive, or if, as is sometimes the case, it

will cut to better advantage by turning it half way round, bringing the top to the end of the frame, this is allowable. Place the frame over the comb in such a manner as to bring the brood as near the top and center of frame as possible, as this is the warmest position in the hive. Cut the comb to fit snugly in this positon. If the comb is not large enough to fill the frame, use from the combs first removed to fill up with. Push the free end of the transferring sticks through the grooves where the combs need support, and fasten to the other end by winding the end of the wire tightly around it, which will hold the comb firmly in place. Use a sufficient number of sticks



a Fig. 55.—TRANSFERRED COMBS. *b*

to secure it properly. Do not let them cross the brood any more than is absolutely necessary (fig. 55). Place the frame in the hive it is to occupy, and proceed with the next brood-comb in the same manner. Let them occupy the same relative position as before, keeping the brood as compact as possible.

If there are combs without brood sufficient to fill one or more frames, place them at the outside, with the brood-combs at the center. Cut off all round, finished edges, and avoid cutting the combs to waste ; all pieces of dry comb too small for use should be kept for beeswax. Drone-comb should be reserved ; if white, save it for guides in surplus boxes ; if dark, put it in frames for extracting. A dish should be at hand to receive such portions of comb-honey as are not put in the frames.

Brush all bees from the window into the hive, with a

damp wing, and take to the old position on the stand. Empty the bees from the box, in front of the hive, and see that all enter. Contract the entrance, and in all ways prevent robbing. A little honey left on the outside might excite plundering, and the colony is not now in good condition to repel attacks. If they are strong, the bees will soon join all the parts, and fasten all the combs securely to the frames, when the sticks may be taken off and laid away for future use. For their first experiments in this direction beginners should select a hive with old, tough, and straight combs.

Capt. Hetherington prepares his frames for transferring, by boring holes through all four sides of the frame, about once in two inches, and fastens the combs in place, by sticking the thorns of the red haw through these holes into the edges of the comb. As these are very tough, and do not need to be removed, they make the comb very firm, and less liable to break out when handling. He has practised this method very extensively, and considers it superior to any other. It is desirable to find the queen, if possible, when driving the bees into the box, and cage her. After the transferring is completed, place the cage on top of, or between the combs, when the bees will more readily gather among them. When they become quiet, she may be liberated.

CHAPTER VIII.

QUEENS.

IMPORTANCE OF SELECTING GOOD STOCK.

The prosperity of every swarm depends very largely upon the queen. This being true, too much importance cannot be attached to the necessity of keeping each hive supplied with a good queen. In all other branches of stock-raising

we select the finest stock to propagate from, if we expect to secure the best qualities. We also apprehend the necessity of introducing from time to time, superior strains, and of breeding from parents not akin. Who can fail to perceive the injury that must have come to our native bees from two sources, viz., from being propagated from inferior stock, and from in-breeding?

A prime consideration then, preliminary to the proper rearing of queens, is, that at least two distinct strains of blood of best quality should be represented. This is easily done, if Italian stock is to be raised, by ordering tested queens from different breeders, who are known to have procured their stock from distinct sources. In purchasing such queens, do not hesitate to pay a good price for a first-class queen. Every breeder has queens which he values at high prices, and if you can secure one that a reliable dealer considers worth $5.00, you are fortunate, even when ordinarily good ones are selling for $2.00.

It will be seen, as we proceed, that the quality of the strains from which the queens are to be reared, may be definitely determined, as the brood used may be taken only from colonies containing selected queens. But the characteristics of the drones by which these choice queens are to be fertilized, will be much more uncertain.

It is true we can prevent the swarms from which we rear our queens, from producing drones, thereby setting one obstacle aside; and it is also evident that we need not allow any but selected colonies to rear drones, by removing drone combs, and destroying such drone brood as is objectionable. If any mature drones are in the way, they may be removed as follows: Cage the queen, brush all the bees from the combs into a box, and place over it a board, with an opening, across which are nailed strips of tin or zinc, precisely $^{5}/_{32}$ in. apart. These openings will permit the workers to pass into the

hives, which should be placed above, containing the caged queen, while the drones are retained in the box.

Drone combs may be supplied to these chosen colonies, and the bulk if not the whole of the drones in our apiary be furnished from such stock. Yet there are native, or inferior bees in almost every section, so near, that our choice queens are liable to be fertilized by their drones.

If I were able to recommend a practical method of securing with certainty, the impregnation of our queens, by selected drones, it would afford me great gratification.

FERTILIZATION IN CONFINEMENT.

This subject has received special attention, and in several instances, success has been reported. While associated with Mr. Quinby, we experimented upon it thoroughly, with the aid of every suggestion that had been given by those who advocated it most strenuously, and in every instance we were unsuccessful. We used enclosures of all dimensions, from a lamp chimney up to a room 8 ft. square, covered at top, and each side with wire cloth and glass. I have witnessed the queen as she came naturally forth from the hive into this room, and was surrounded by drones on the wing, yet in no single instance did we attain the desired result. But the fact that we have not been successful is by no means proof of its impossibility. Many who have experimented in this direction express themselves confident of success.

Prof. Hasbrouck of Flatbush, L. I., in a paper read before the National Convention held in New York in 1878, states that in many instances he has witnessed their mating in small boxes upon the top of his hives. It is, however, so far from being uniformly successful, that a practicable method for accomplishing it can not yet be confidently recommended. But I anticipate the time when

persistent experiment will overcome present obstacles, and achieve the desired result. An earnest wish may prompt this opinion, for, if successful, the result must be a higher standard of purity, and an excellence not otherwise to be attained.

REARING QUEENS.

WHEN TO REAR.

The first step necessary is to secure a supply of drones from such stocks as may have been chosen for the purpose. It is usually better to select such swarms the season previous, furnish them drone comb, and mark them so as to identify them. As in most other active operations of the apiary, the time at which queens may be profitably reared, will vary in different seasons and localities. It will be seen that I do not advocate as early operations as many writers. I have sometimes succeeded in stimulating swarms to unusually early breeding, but such efforts have never resulted profitably.

In a climate like Central New York I shall not advise rearing queens before apple blossoms appear, which is here from the 12th to the 20th of May.

Swarms that are queenless before this time should be united with others that have queens. Even at this date queen-rearing will be found somewhat vexatious, especially if the weather is unfavorable, and the usual scarcity of honey follows, as it will necessitate feeding.

The nuclei will also need to be much stronger at this time, than later in the season. If it is desired to rear Italian queens at such times as native drones will not interfere, it may often be done by stimulating Italian colonies to early breeding in spring; or a native stock may have Italian drone-brood given it towards fall, and if they are kept queenless, they will keep their drones late in the season, after the native drones are destroyed. I have suc-

ceeded in rearing fine Italian queens as late as October, when the weather was very fair, which were fertilized by such selected drones.

I think it wise, as a rule, not to attempt to rear any great number of queens until June, when the interval of scarcity after apple-blossoms has passed, and the subsequent flow of honey has commenced. The point which I desire to impress is this, that queen-rearing should be carried on, as far as possible, when the bees are gathering honey most abundantly. There is probably no more auspicious time than during the swarming period. I would avail myself of every opportunity to preserve the oldest and best developed queen cells, from suitable stock, where preparations had been made for swarming.

HOW TO REAR QUEENS.

I here give place to a paper by M. Quinby, which has received the hearty approval of many of our most capable bee-keepers. He says:

"* * * I have studied well the conditions that produce good queens, as well as inferior ones, and I have never yet found a queen that will duplicate herself on every occasion, unless it is one of the common variety. I can count a few dozen, perhaps, after which will be some variation. I have settled down pretty much on one system:

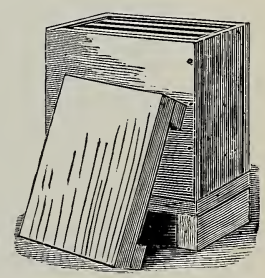


Fig. 56.—NUCLEUS BOX.

"First, make a nucleus box, five inches wide, seven inches long, and six inches high, holding, at least, three combs (fig. 56). These combs should contain honey enough to last two or three days, or more. Now, go to the hive from which you are breeding, and obtain a piece of worker-brood comb, nearly three inches long and about

half an inch wide (fig. 57). This should be new, if possible. The larvæ should not be less than two nor more than three days old, from the egg. In the center of the middle comb cut a space three inches long by an inch deep. Insert this piece of brood, which is supported at the ends, by the shape, as shown in fig. 58. Allow no more brood in the box. In the middle of the day when the bees are flying, take out from a strong colony that is

Fig. 57.—COMB, WITH BROOD FOR QUEEN RAISING.

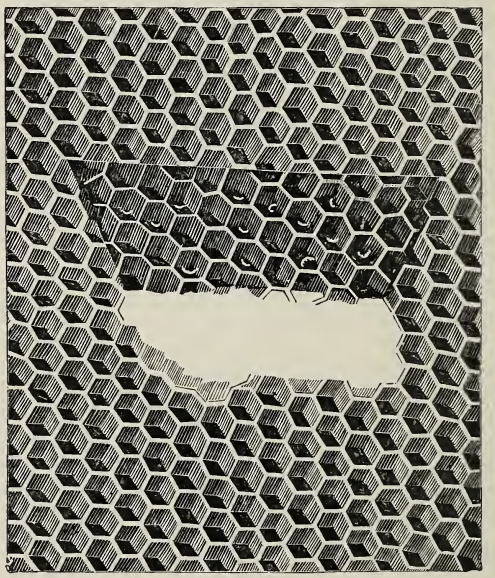


Fig. 58.—COMB, AS ABOVE, INSERTED IN COMB.

maturing brood, a little less than a quart of bees, nearly all of which will be young bees, which are thought to be better nurses. Shut them in the nucleus box thirty-six or forty-eight hours, and then let them out. They will

build several queen cells (fig. 59). If the brood was just the right age, they will be likely to hatch in ten days, not less. At the end of that time, look early in the morning, and if you can cut any of them out without injuring the others, do it, but leave one. If joined so that you will have to destroy a part to separate them, leave them, but examine several times through the day, and if any hatch, remove them at once ; I have found four hatched, at one

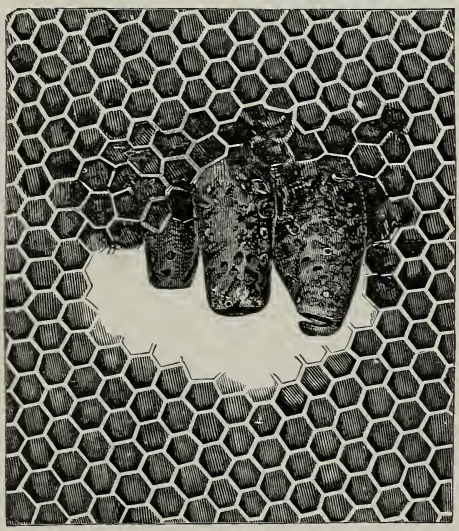


Fig. 59.—QUEEN CELLS ON COMB.

time. The cells that have been cut out may be used to supply other nuclei, or they may be transferred to the queen nursery (fig. 60). I claim that I can raise, thus cheaply, as good queens as can be obtained. I feel like saying better than those will average, where a full colony has been employed to raise a dozen. I know that I am on delicate ground. Some of my best friends, who are earnest in their wishes to advance the science of bee-culture, will pity, perhaps condemn me. If the reasons that I

give are not sufficient to sustain the system, let it fall; I want it upheld by merits of its own, or not at all.

"How is it with natural swarms? Ten or fifteen cells are often made where a swarm has issued. The first are made under the impulse of the swarming fever. If the swarm issues before any are sealed over, very many will be started at once. Some of them, however, after the swarm has left, receive much less attention than the first ones did. If want of attention makes an inferior queen in case of artificial rearing, can any one say why the same causes will not produce the same results here? We are not likely to ascertain for a certainty, as all except two or three of the first are destroyed. But when we come to imitate natural swarming, in a sense, by removing a queen from a full stock, and claim better queens in consequence, we can test it somewhat. We find in the attempts to replace the mother, a still greater diversity in the time of starting cells. It is reported that some queens will hatch in nine days, some in ten, others sixteen and eighteen, and at all intermediate times. Those hatching under ten days are claimed to be deficient in development, and short-lived. I never had any nine-day queens, and cannot say. Those that are slow to mature are quite apt to be deficient. I do not say that some such do not make beautiful queens, but the average is no better than ten-day queens.

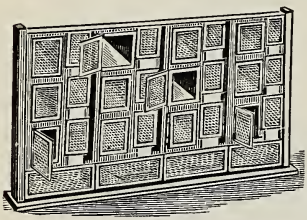


Fig. 60.—QUEEN NURSERY.

"When first deprived of the mother, the bees make cells over larvæ, without seeming to care much for a convenient place; after the first impulse is over, they find a good place occasionally, and commence other cells, but having a large number already, they work as if they cared little for these last. They seem to nurse such for want of

something to do—never expecting to need them. They may be all right, except late, and just sealed over when the first one hatches. It is hardly possible to cut out such an unripe cell, and get from it a good queen. Until a queen has its shape and begins to get color, it is very delicate and tender. The cell is twice the size necessary to hold it, and if it is cut off, and only turned over—even if carefully done—it falls from one side to the other, and is bruised badly, making it a cripple, and inferior in color.

"Some of the advantages of the nucleus system may be found in the particular care of a few points.

"1. I want new comb for the brood, as cells can be worked over out of that, better than from the old and tough. New comb must be carefully handled. If none but old, tough comb is to be had, cut the cells down to one-fourth of an inch in depth. The knife must be sharp to leave it smooth, and not tear it. The bees will enlarge and turn downward such shallow cell nearly as well as on new comb.

"2. Clean comb in condition to lay in, must be given the bees in the brood hive frequently, perhaps every day, if rearing many queens. Look every day, so as to know just when the queen lays in any comb. You should cut out the brood in five or six days from the time the eggs are laid, and be sure of queens hatching in ten or eleven days afterward, according to the age of larvæ. As all the eggs in the comb were laid within a few hours of each other, all will mature about the same time; such cells can be cut out and handled without injury. A colony may be deprived of its queen, and receive a cell the next day which will hatch in a few hours. As there are but few brood cells given them, the nurses in proportion are even greater than in full colonies. Remember, this is all the brood they have to take their attention. They have just realized their need of a queen; they have the means placed conveniently, with space underneath; they work

with a will, having no earlier or later ones to choose from, and in three days all are sealed up.

"Compare these queens with those raised in hives full of brood. I do not claim to get better queens, but may I not claim as good, and more uniformly good? Just give the nucleus an additional comb of brood of all ages the next day, and no convenient place cut for queen cells, and they would start but few. There are too many young bees to be cared for, like the full stock. Many of those started would be neglected. Have I made it clear that nurses and brood can be economically adjusted?

"When the young queen has commenced laying, and has been removed, new brood can not be given to the bees and they be expected to rear as many more queens willingly. They should have some of the cells ready made, given them, making themselves useful in caring for queens until they lay. Whenever another batch of cells is wanted, introduce another supply of nurse-bees, and work as before."

ANOTHER METHOD.

There is another method of rearing queens, which in many respects I prefer to the one just described. I practice both, yet, considering all essential features, I have a preference for frames uniform in size with those in the hive, for all operations, as thus honey and bees can usually be more conveniently supplied. Yet, if the small nucleus boxes are used, honey may be secured in the flush of the season by furnishing the small frames filled with empty comb or foundation, to these boxes, after removing such as have been filled with honey. I have often been able to obtain a large number of such combs well filled and capped over, which I have saved with proper care, until wanted for similar purposes the following season. The full-sized frames for nuclei are preferable because the bees used to rear the queens are of value, if swarms

are to be built up artificially (as hereafter directed), and are already in the hives designated to receive such swarms.

The process of rearing queens in full colonies is as follows: Select the stock from which it is desired to secure queen cells. Remove the queen, and place her in a hive prepared to receive her, or use her to supply any deficiency that may have occurred. The bees, finding themselves destitute of a queen, will proceed to construct queen-cells, which should be cared for as directed in this chapter. If it is preferred to use a stock of native bees, which are thought by some to be better nurses, remove the queen, and take from them all the combs containing eggs and brood, in its first stages. These combs may be placed in hives which need strengthening, after shaking and brushing all bees back to their own stand. Now, take from the hive possessing the queen, whose brood you wish to secure, such combs as contain larvæ of the required age. If this hive had been supplied about six days previously with clean white worker-combs, placed in the center of the brood-nest, it would probably contain larvæ in just the desired degree of development. Besides, when tender combs are used, queen-cells will be more readily started, with the chances in favor of a larger number. Remove the bees from these combs, and place the latter in the native swarm prepared for them.

It is not best to expect more than ten or twelve cells from each hive thus arranged, yet when all the conditions are favorable, I have sometimes had a much larger number started. If several colonies are to be prepared in this way, it is better to do it on successive days, that the queens may not mature so nearly at once, so that a less number will need care at the same time. In eight days after the above operation, the combs may be carefully lifted out, and the number of cells ascertained. In some instances they will be built so closely together, that they can not be separated with safety to all. For instance, if

five cells are built in a cluster, the one in the center and two on the outside can only be saved by cutting through the two others. During these operations, it is necessary to handle the combs with great care, keeping them in the same position as when in the hive, that the queens may receive no injury.

FORMING NUCLEI.

If the queens are to be used for new swarms, arrange the requisite number of hives in the different positions in the apiary, that you wish the swarms to occupy. It is my practice to purchase native bees in box hives at this time, and transfer the combs and bees to such hives (as directed in Chap. VII., on Transferring), giving each nucleus one comb containing brood, and about one quart of bees. From a good box hive I form from six to eight nuclei. Also, I sometimes bring a colony already in movable frames, from another apiary, and divide it in about the same number of parts. In either case, the queen is removed, and used where one is desired. These bees will usually remain more contentedly if they are confined to the nucleus for the first twenty-four hours.

Another practical method is to open a hive in the same apiary, and after securing the queen, remove from it a card containing brood as fully developed as can be determined by the looks. Place this in one of the nucleus hives prepared, with a close fitting division board at each side, if a hanging frame is used, or the panels with the standing frame.*

Now, remove three or four other combs from the same hive, and after giving them a sudden shake in front of their own hive, to dislodge the old bees, take them to the nucleus, and brush all the young bees that cling to them, into it. This will usually furnish a sufficient supply of

* These division boards or panels should be used in all nuclei formed in large hives, to economize the heat.

bees for a nucleus. Return these last combs to their own hive, supply the place of the one removed with a frame of foundation or comb, and return the queen. This method will be advisable where but one or more stocks are kept. In this case it would not be necessary to prepare a swarm from which to take cells. The nucleus swarm may be allowed to construct cells, the best of which may be selected. Proceed as above, with other good hives, until the desired number is obtained. The second day after these are formed, the cells in the hive in waiting will be ten days old, and the most advanced be liable to hatch. If only eggs had been furnished, from which these queens were to be reared, they would not mature under sixteen days from the time the egg was laid. On the evening previous, or on the morning of the tenth day at the latest, remove the cells with a very sharp small-bladed knife, and place them in a box for the purpose, always handling them with extreme care (see fig. 66*b*). If any one of these queens is allowed to hatch before they are cared for, she will be likely to destroy all the rest. This she accomplishes by biting into the side of the cell and stinging her helpless rival (see fig. 66*d*). The box should contain a portion of cotton or wool, to make it soft (fig. 61). If a laying queen is at hand, she may be introduced to this stock. Now, distribute the queen-cells among the nuclei, being sure to place them near the cluster of bees, where they will be protected.

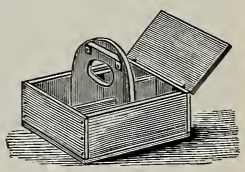


Fig. 61.—QUEEN-CELL BOX.

I sometimes add another empty comb to the nucleus, and merely place the queen-cell between the two, where it will occupy a natural position. At other times I simply make a hole through the comb, large enough to receive the cell, with the lower end slanting downward. I have sometimes introduced the cells to the nuclei as soon as the

latter were formed, but the bees are more liable to destroy them, than when the nuclei have been established for a day or two.

These cells given the nuclei will usually hatch during the next four or five days. If they fail to do so, it is best to supply them with other cells. Care must be taken to remove any cells that may be started upon the combs furnished these hives. Also, as the queens appear, they should be examined to see if they are perfect in all respects. As they are removed for various purposes, other cells may be furnished. The queen will fly out for fertilization in from four to six days from leaving the cell, under favorable circumstances. In three or four days after impregnation, she will usually begin to lay, when her wing may be clipped. If she does not begin within two weeks from the time she was hatched, I would advise destroying her.

QUEEN NURSERY.

Dr. Jewell Davis, of Illinois, has invented what is called a queen-nursery, designed for hatching and holding extra queens. Its dimensions correspond with those of the frames used, and it may be placed in a full hive for the purposes indicated (see fig. 60).

QUEEN CAGES.

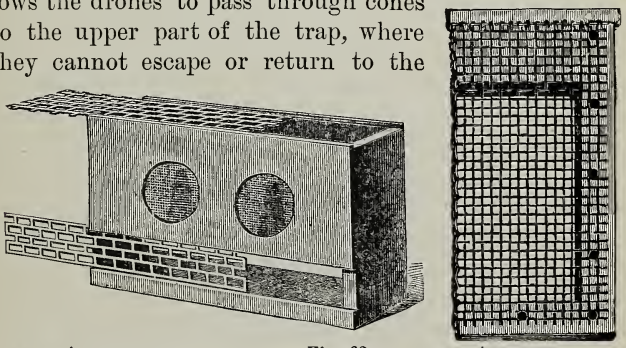
A simple and practical queen-cage is essential in every apiary. A goodly number of them should always be on hand convenient for immediate use. A good one that will meet all requirements is shown in fig. 62, *b*. Make it of light wire-cloth, eight mesh or eight wires to the inch.

The open end should be made of the selvedge of the wire-cloth, or if a cut edge is used, one wire should be ravelled out, and all the ends nicely bent back, as the queen would be likely to receive injury while being caged, if the sharp ends of the wire projected at the edge.

Prepare a close-fitting stopper, which completes the cage. If an opening is cut in the stopper, and filled with candy, it will furnish ready food for the caged queen at all times. Candy for this purpose is made by using "A" sugar with a small proportion of flour, and a little water. Boil it in a saucepan, stirring until it begins to grain. Then fill the cavity in the stopper with this syrup while it is warm, when it will harden.

ALLEY'S DRONE EXCLUDER, AND QUEEN TRAP COMBINED.

This is one of Mr. Alley's latest inventions. It is so constructed that it may be adjusted to any hive. It allows the drones to pass through cones to the upper part of the trap, where they cannot escape or return to the hive. They may afterwards be returned, destroyed or used as desired. It will readily be seen that this trap is not open to the objection raised by some that the drones are held where they are in the way, and clog the passages of the working bees. The advantage to be gained in the use of these traps by allowing only such drones to fly as one desires his queens to meet, is evident. It is also of value in preventing the escape of the queen. As a swarm will never leave without a queen, loss of swarms may thus be prevented. These traps are so neatly made as to be an ornament to the apiary. See fig. 62, *a*.



a, ALLEY'S DRONE EXCLUDER. Fig. 62. *b*, QUEEN CAGE.

INTRODUCING QUEENS.

Four points are necessary to observe in introducing queens.

1st, that the hive contains no queens or queen-cells.

2d, that the bees are all induced to fill themselves with honey.

3d, that the queen is pervaded with the same scent as the bees to which she is introduced.

4th, that she be introduced in such a manner, that she will not be hastily met as an intruder.

A failure to meet the first requirement often results in the loss of queens. A cell may be hidden in a sly place and overlooked. For instance, I have known queen-cells to be made between broken edges of transferred combs, which were afterwards built over and concealed, so that no indication of a queen-cell appeared. The fact that such may be the case, favors the immediate introduction of queens. Let us notice some extreme cases where a queen may be present. I have removed a queen that had a defective leg, or that was becoming unprolific, intending to supply her place with another. It was supposed, of course, that being the rule, that no other queen was present; but during the process I have noticed a cell from which a queen had just issued; and upon further examination, have found the young queen in another part of the hive. The mode of confining the queen for 24 or 48 hours, after the old one is removed, is often practised, but I have known cases where a young queen has entered such a hive during this time, and destroyed the one introduced as soon as released. I mention these instances as I have had them occur in my own experience. The presence of fertile workers often causes the loss of queens when introduced, as the bees are less willing to receive her at such times. The resource in such instances, is, to

furnish them brood from which to rear a queen, which they will generally accept.

2d. The bees may usually be induced to fill themselves with honey by smoking, yet it is sometimes desirable to sprinkle them with liquid honey or syrup, for the purpose. If honey is not being gathered, the necessity for operating when all the bees are in the hive, at morning or evening, so that all may be induced to fill themselves, will be evident.

3d. It has been recommended to add to the syrup or honey some kind of essence which would give them all the same odor. Others depend upon smoke, using tobacco as a preference. Whatever scent is used, both the queen and bees should be pervaded with the same.

4th. The covering of the queen with honey or syrup will attract the bees when she is placed among them, and they will realize her identity as a queen while licking her off. I usually find rotten wood sufficient for smoke, and the use of honey from the hive which is to receive the queen will ordinarily afford the required similarity of odor.

Among the varied methods of introduction, that which will allow the new queen to be introduced soonest after the old one is removed is most desirable. If I were to introduce a very choice queen with the least possible chance of losing her, I would make a stock queenless, and leave it in that condition eight days. The queen-cells which they naturally construct should then be removed, after smoking thoroughly, and as they would be expecting a queen, and deprived of eggs or larvæ from which to rear her, they would undoubtedly be in a favorable mood to accept her majesty. If the queen is now smeared with honey, and placed between the frames at the top, there is hardly a chance that she will not be accepted. If the bees are busy collecting honey, the work may be done at any time of day, but when honey is but sparingly gathered, I prefer doing it after the bees stop flying at

night. It will also be necessary to smoke them more thoroughly at that time. Although most safe, this mode of introducing queens is not altogether desirable. I would prefer to lose one queen in five, and introduce as soon as the old queen is removed, rather than leave the hives queenless the stated time, and lose none. If it is found necessary to change queens in hives that are being extracted at intervals, it may be done easily and successfully. At a time when the bees are gathering honey in most profusion, and the combs are frequently extracted, the bees will be most completely demoralized, and generally gorged with honey. I have had no trouble in taking away the old queen at such times, and installing a new one in her place. Some introduce a queen by putting her in a cage, and tying a piece of thin muslin over the open end, or by using comb for a stopper, which the bees will bite away, and thus affect her release. Others construct a cage of different proportions, leaving one side open, instead of the end. Then a hole is made in a comb filled with honey, by thrusting a knife through, turning it around, and withdrawing it without removing any of the comb. The queen is then confined to one side of the comb by placing the cage over her, and crowding it against the comb. The bees will clear the opening and release the queen. I have practised this method successfully, but, as a rule, I would prefer releasing her from the cage, instead of allowing the bees to do it. In all cases, an examination should be made at a suitable time to become assured of her safety.

When it is desired to Italianize native stocks, it is simply necessary to remove the native queens, and introduce Italians. In twenty-one days, the young Italian bees will begin to appear, and in six or eight weeks, in the busy season, the natives will all disappear.

CLIPPING QUEENS' WINGS.

This practice is thought by many to be one of the new discoveries of the age. Mr. Langstroth tells us in his work that it was followed in Virgil's time, and also mentions an account bearing date as early as 1766, of a bee-master in Spain who carefully clipped the wings of his queen-bees, to prevent loss by swarming. There are, doubtless, some slight evils incident to the practice.

I am satisfied that I have had many fine queens superseded from the dissatisfaction of the bees with a queen with this imperfection. I do not imagine, however, that it is any real detriment to the value of the queen. There are so many arguments in favor of the practice that I could not relinquish it, even if it involved a much greater loss. The chances of loss from other sources are very much reduced, and the benefit realized in various operations, as demonstrated herein, proves its utility and entire practicability.

THE PROCESS.

It may be done with a sharp knife, or with a pair of scissors. If a knife is used, grasp the queen by the forward part of the body, and place the wing to be removed upon a smooth surface, and cut about one half of it away (fig. 63). If scissors are preferred, use those with round points, as they are less liable to injure the queen, and may be more safely carried in the pocket than sharp pointed ones. The inexpert would do better to handle the queen by the wings.

Fig. 63.—QUEEN WITH CLIPPED WING.

HOW TO HANDLE A QUEEN.

To handle a queen with perfect safety to her majesty requires some experience. Never allow the least pressure

to come upon the abdomen. They may be often confined in a cage, without touching with the hand. Place the cage in front of her upon the comb, and with the stopper gently induce her to enter. If one or more bees pass in with her, all the better. When ready to liberate her, she will pass from the cage to the combs without difficulty. The form of cage described was designed with this special point in view. The value of a good queen should ever be borne in mind, and in all operations great care exercised, that she does not receive injury. When they are depositing eggs most freely, they become very large and heavy, and will sometimes drop to the ground during the manipulation of the combs. To avoid this, have a cage at hand, and confine the queen during necessary operations with the combs, and return her when ready to close the hive.

AGE OF QUEENS.

The bee-keeper should keep a record of the age of all the queens in his apiary. Some advise hanging a small slate upon the front of each hive, and for making any immediate record, it will be found very convenient. I advise numbering each hive, and using what I call a yard-book, devoting a page to each hive, numbered to correspond. In this book, the age of the queen may be kept, and any other facts which it may be useful to remember. I have kept such books for each apiary away from home, with much satisfaction. It was our habit to visit such apiaries once each week. I have studied the condition of these colonies as recorded in this book, the evening before visiting them, and found myself working much more understandingly the following day.

When one has purchased a valuable queen at much expense, or if one has been reared that proves to be more than ordinarily good, the owner will be slow to destroy her, so long as she deposits worker eggs, even though she

becomes less prolific, until she is four or five years old; but for the majority of queens this will not answer. I shall not advise retaining queens longer than three years. Several years ago I argued at one of our "North-Eastern Bee-Keeper's Conventions," that, where bees were kept in the old way in a hive with a small brood-chamber, and the queen was only required to deposit a limited number of eggs, she might be expected to remain fruitful for a longer term of years than under the present system of management, where the motto is "a large force for a large amount of work." For we now use every possible means to secure the largest amount of brood, often trebling the number of bees that would be reared in a small box-hive with no care.

The idea was almost, if not quite, unanimously rejected at that time, but later experience confirms me in the opinion that queens will fail sooner under the present system, than with the old methods.

I consider then, that as a rule three years should be the average limit of a queen's age, and many will become useless earlier. Ever have an eye to the queen, and if she become deficient in any way, let her place be supplied with a good one. Do not allow the bees to supersede her themselves, which they might do to a disadvantage.

DRONE-LAYING QUEENS.

Drone-laying queens are usually such, as from any cause, are unable to meet the drone for impregnation. Such queens will only produce drone progeny. They often deposit their eggs in worker combs, but as the brood approaches maturity, the cells will be extended about $^1/_8$ in. before being capped over, which gives the surface a rough appearance, as such brood is always somewhat scattered (fig. 64). It requires but little experience to recognize these indications of an imperfect queen.

Old queens often come to this same condition. These we term "spent queens." They will deposit but few eggs, which will produce only drones. The judicious bee-keeper will seldom allow his bees to reach this state. I have known swarms that went into winter quarters with an apparently good queen, to come out in spring with a drone-layer. Mr. Langstroth gives us proof that hunger and cold will reduce a prolific queen to this condition. He and others have exposed fertile queens to a very low temperature, and they were afterwards unable to deposit other than drone eggs.

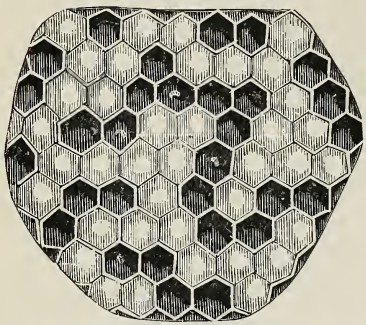


Fig. 64.—BROOD FROM DRONE-LAYING QUEEN IN WORKER-CELLS.

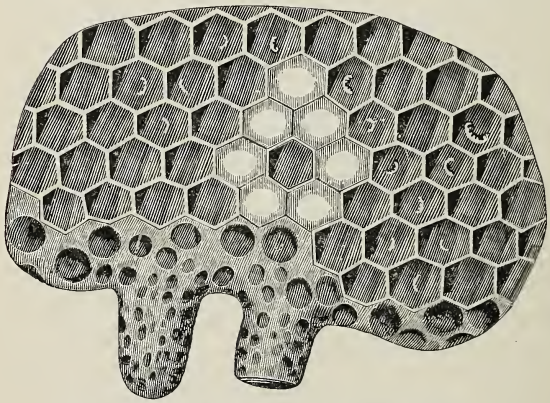


Fig. 65.—QUEEN-CELLS OVER DRONE BROOD.

It is quite common for bees that have none but drone eggs, to try to rear a queen from them, but every such effort is fruitless. Cells of this kind are shown in fig. 65.

LOSS OF QUEENS.

A critical time for our queens is when they leave the hive or nucleus to meet the drones. They are liable to be caught by birds, and at times, fail to enter their own hives on their return. This is an excellent reason for not setting hives too closely together, and also, for using a variety of colors in roofs or hives, to assist them in identifying their own homes. An examination should be made at the proper time to ascertain if the queen has safely returned.

INDICATIONS OF LOSS.

The next morning after a loss of this kind has occurred, and occasionally at evening, the bees may be seen running to and fro in the greatest consternation on the outside. Some will fly off a short distance, and return; one will run to another, and then to another, still in hopes, no doubt, of finding their lost queen. A hive, close by, will probably receive a portion, and will seldom resist an accession under such circumstances. All this will be going on while other hives are quiet. Towards the middle of the day, the confusion will be less marked; but the next morning it will be exhibited again, though not so plainly, and will cease after the third, when they become apparently reconciled to their fate. They will continue their labors as usual, bringing in pollen and honey. Here I am obliged to differ with writers, who tell us that all labor will now cease. I hope the reader will not be deceived by supposing that the collection of pollen is an infallible indication of the presence of a queen. I can assure him it is not always the case.

When such conditions are noticed, it is well to examine the hive to see if a queen can be found. Or, if the bee-keeper is inexperienced in finding queens, he may mark the date, and after a day or two has passed, look for

queen-cells, and if any are found, containing larvæ, it will indicate the absence of the queen. Additional evidence is furnished by the absence of eggs in the brood-combs. The necessity for keeping colonies supplied with queens, and the means therefor, are indicated in the chapter on "Increase."

MORE THAN ONE QUEEN IN A HIVE.

While it is a rule that each colony will contain but one queen, there will occasionally be exceptions. As mentioned in regard to introducing queens, I have had proof of these exceptions in my own experience. We have also the testimony of others to the same effect. I knew an instance where the old queen was allowed to remain with the young one until they were put in winter quarters. Mr. Ira Barber, of this State, had two queens in one hive during the latter part of the season, which were wintered together. I mention these instances to show that many of the habits of the bee may be sufficiently uniform to constitute a rule, yet it is hardly wise to consider them invariable.

CHAPTER IX.

NATURAL AND ARTIFICIAL INCREASE.

NATURAL INCREASE.

Good bee-keepers differ widely upon this subject. Many claim that no method of increase can equal natural swarming, but it has become a conviction with most, if not all, intelligent bee-keepers, that there is a wiser way than to allow unrestricted natural swarming. Let us notice the condition of a hive, previous to, and during the swarming interval. For several days before the issue

of the swarm, the queen matures but a limited number of eggs, becoming reduced in size nearly to that of a virgin queen, in order to be able to fly out with the swarm, and upon the day of swarming, even the worker bees are comparatively idle. Now, if second and third swarms are allowed to issue, these hindrances are multiplied. The 2nd will issue 8 or 9 days after the first, and the 3d, about 3 days later. In about 18 days from the date of the first swarm, a young queen will become fertile, and ready to commence laying. Thus it will be seen that the colony has been destitute of a laying queen, for, at least 18 days, at a season when a large working force of bees is especially valuable. Allowing a deficiency of 1,000 eggs per day, which is a very moderate estimate for a prolific queen, it would make a difference of 18,000 bees.

In regions like California, where the swarming season occurs before the general honey yield, swarms may be increased, and brought to a condition to store honey rapidly before the general harvest begins. There too, the increase may be profitably large, with a proportionate gain in surplus. But in our latitude, where the duration of the yield is comparatively short, and the swarming season is simultaneous with it, a different system must be pursued. A fact to be borne in mind at all times, is, that much better proportionate results are reached, in strong colonies, than when the bulk of bees is less. This is, of course, subject to limitation. It is true in the quantity of honey they will gather in summer, and consume in winter, in the amount of brood they will rear, as well as in rapidity of wax-secretion, and comb-building. Besides, they have but one set of combs, and one entrance to protect against their enemies.

The motto adopted by all progressive writers, "Keep all colonies strong," is one of the fundamental principles of success. To this I would add, "Each colony should at all times possess a laying queen." As this can

not be the case, when swarms are allowed to issue naturally, the deduction is, that this course is not productive of best results. Yet, as there are very many who will continue to follow this system of management, until they more fully appreciate the advantages to be gained by changing it, I shall give some space to Mr. Quinby's directions concerning natural swarming.

In the previous editions of this work, as well as in all books upon the subject up to the present day, this has been considered as one of the most interesting topics to be discussed. With his usual attention to minute details, Mr. Quinby gave very profuse instructions for all possible emergencies, but I shall only make such quotations as are most essential for beginners, and those who have not come to practice the most advanced modes of increase of colonies.

WHEN SWARMING COMMENCES.

The swarming season in this latitude sometimes commences May 15th, and at other times July 1st. It usually ends about the 15th of the latter month. I have known two seasons in Montgomery Co., N. Y., when swarms continued to issue throughout the entire summer, beginning in May and ending August 25th, with no interval of more than a week without swarms. One of these, 1863, was wet, and the flowers yielded but little honey. The native bees sent out about one-third the usual number of swarms, while the Italians continued to swarm for three months. They did not store much more honey than others, but they must have collected more to feed the greater quantities of brood which they reared. Rather than be idle when the yield was scanty, they collected material, made combs, reared brood, and sent out swarms; and at the end of the season the colonies were as strong, and had as much honey as the natives, which had not swarmed.

The bee-keeper who thinks much of his bees will, of course, wish to see and hive his swarms as they issue. If neglected, for even a short time after they cluster, they will often relieve themselves from such protection, and seek the shelter of some old tree in the woods. Without some knowledge of the indications of swarms, we often watch vainly for weeks, remaining at home, and perhaps neglecting important business in the fruitless expectation that the "bees will swarm." External appearances are not to be depended on. Very early swarms often issue before clustering out; also, they very often cluster out without swarming. It is necessary to look inside the hive for reliable indications.

INDICATIONS OF SWARMING.

To a novice, this operation is apparently formidable. But with protection for the face, and the aid of a smoker, the magnitude of the performance is greatly diminished, and will grow less with every repetition. The hives should be examined in the middle of the day. Lift out the frames, and look for queen-cells. If there are none containing eggs or larvæ, or none with thin, smooth walls, evidently just begun, there is not much prospect of a swarm for several days. But if any cells contain eggs, or larvæ nearly ready to seal over, or are actually enclosed, we know at once what to expect. When sealed over, the swarm will probably issue the next day. This is at the beginning of the swarming season. If at or near the close we examine again, and find the queen-cells destroyed, we conclude that they are done swarming.

I have found the requisites for all regular swarms to be something like this. The combs must be crowded with bees; they must contain a numerous brood advancing from the egg to maturity, and the bees must be obtaining honey either from flowers or artificial sources. *

* To these I would add scarcity of room for brood.

A surplus of bees in a scarcity of honey is insufficient to bring out the swarm, neither will plenty of honey suffice, without the bees and brood. The period of proper duration in which all these conditions exist will vary in different stocks, and many times does not occur at all during the season.

PREPARATIONS FOR SWARMING.

Queen-cells are about one-third done when they receive the eggs; as these eggs hatch into larvæ, others are begun, and receive eggs at different periods for several days

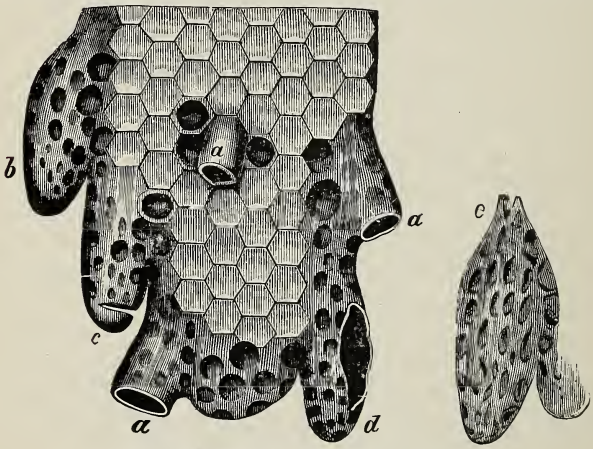


Fig. 66.—CLUSTER OF QUEEN-CELLS.

a, a, a, Size of the cell when the egg is deposited; b, Finished cell; c, Cell from which a mature queen has issued; d, Cell in which the queen has been destroyed by a rival and removed by the workers; e, Queen-cell cut from the comb.

later. The number of such cells seems to be governed by the prosperity of the bees; when the family is large, and the yield of honey abundant, they may construct twenty, at other times not more than two or three, although several such cells may remain empty. When there is nothing precarious about the supply of honey,

the sealing of these cells indicates the first swarm, which will generally issue on the first fair day after one or more are finished.

WHICH BEES COMPOSE THE SWARM.

It is probable that no rule governs the issue of the workers. Old and young come out promiscuously. A great many old bees may be seen in late swarms, with wings so worn as to be unable to fly with the load of honey which they attempt to carry. That young bees leave, any one may be satisfied on seeing a swarm issue. A great many, too young and weak to fly, will drop down in front of the hive, having come out now for the first time, perhaps not an hour out of the cell; these very young bees may be known by their color. That these may creep back to the hive, is another inducement to set it near the ground. The old queen often gets down in the same way, but her burden of eggs is probably the cause of her inability to fly. That the old queen leaves with the first swarm is so easily proved with the movable-comb hive, that it is unnecessary to occupy several pages in demonstrating it. After the swarm has left, you have only to examine the combs to be assured that she is nowhere in the hive. The absence of eggs in the cells is other proof.

We will now suppose that some of your colonies are ready to send out swarms, and will also presume that the empty hives for the reception of swarms are in readiness. To prepare a hive after the swarm has issued indicates bad management; negligence here argues negligence elsewhere; it is one of the premonitions of "bad luck."

IMMEDIATE INDICATIONS OF A SWARM.

When the day is fair, and there is not too much wind, first swarms generally issue from 10 A. M. until 3 P. M.

The first outside indications will be an unusual number of bees about the entrance from one to sixty minutes before they start. The utmost confusion prevails, bees running about in all directions. When first rising from the hive, they describe circles of but few feet, but as they recede, they spread over an area of several rods. Their movements are much slower than usual. In a few moments, thousands may be seen revolving in every possible direction. When all are out of the hive, or soon after, some branch of a tree or bush is usually selected on which to cluster. In less than half a minute after the spot is indicated, they are gathered in the immediate vicinity, and all cluster in a body, from five to ten minutes after leaving the hive. They should now be hived immediately, as they show impatience if left long, especially in the sun; also, if another stock should send out a swarm while they were hanging there, they would be quite sure to unite.

HOW TO HIVE THEM.

It makes but little difference in what way they are put in the hive, providing they are all made to go in. If there is nothing in the way, lay the bottom board on the ground, make it level, set the hive on it, and place a wide board before it. Cut off the branch on which the bees are hanging, if it can be done as well as not, and shake them off in front of the hive; a portion will discover it and will at once commence a vibration of their wings, which seems to be a call for the others. A great many are apt to stop about the entrance, thereby nearly or quite closing it, and preventing others from going in. You can expedite their progress by gently disturbing them with a stick or quill. When gentle means will not induce them to enter in a reasonable time, and they appear obstinate, a little water sprinkled on them will greatly facilitate operations, or they may be readily driven in by the use of the smoker.

When they cluster on a branch that you do not wish to cut off, arrange the bottom-board as before directed, then turn a box bottom up directly under the main part of the cluster, and if you have an assistant, let him jar the branch sufficiently to dislodge the bees; most of them will fall directly into the box. If no assistant is at hand, strike the under side of the branch with the box, and when the bees have fallen in, empty them on the board. I have gone up a ladder twenty feet high, got the bees in this way, and backed down without difficulty.

A basket or large tin pan may be taken up the ladder instead of the hive, from which the bees can be readily emptied before it. But very few will fly out in coming down. If you succeed in getting nearly all the bees at the first effort, merely shaking the branch will be sufficient to prevent the remainder from alighting, which will turn their attention below, where those which have already found a hive will be doing their best to call them. Swarms will sometimes alight in places where it is impossible to jar them off, as on a large limb, or trunk of a tree. At such times place the hive near, as first directed, and dip them off with a large tin dipper.* When you get the queen in, there will be no trouble with the remainder, even if there are many left. As soon as they ascertain that the queen is not among them, they will manifest it by their uneasy movements.

They will soon leave and join those in the hive, or if the queen is yet on the tree, even if there be but a dozen with her, those in the hive will leave and cluster again. In all cases they must all be made to enter, and when all are in, except a few that will be flying, carry the hive at once to the stand it is to occupy, and protect them well from the rays of the sun with a good roof. The reasons for immediately removing the swarm to the stand, are,

* Dipping is preferable to brushing with a wing or broom, as the latter irritates them exceedingly.

that they are generally more convenient to watch in case they are disposed to leave, and many bees can be saved. All that leave the hive, mark the location the same as in spring. Several hundreds will probably leave the first day, a few, several times. When removed at night to the permanent stand, such will return to the stand of the previous day, and are generally lost; whereas, if they are removed at once, this loss is avoided.

Those that are left flying at the time, return to the old stock; those that return from the swarm the next day will not always do this. Bees will seldom leave for the woods when put in clean hives, and kept cool. The rank smell of fresh paint is offensive to them, and dark colored hives are often intolerably hot.*

EMERGENCIES.

We will now return to the issuing of the swarms. There will be some emergencies to provide for, and some exceptions to notice. If we keep many colonies, the chances are that two or more may issue at one time; and when they do, they will nearly always cluster together. It is plain that the greater the number of colonies, the more such chances are multiplied. We can, if we are watchful, often prevent the issue of more than one at a time. This depends in a great measure on our knowledge of indications. It is well to know by previous examination, which hives have made preparations for swarming, and as soon as one has begun to issue, look at all the rest that are in condition to swarm; or, what is much better, look before any have started. Even if nothing unusual is perceived about the entrance, examine the boxes. If the bees there are all quiet as usual, no swarm need be immediately apprehended, and you will probably have time to hive one or two without interruption.

* A card of brood from another hive, given to a swarm newly-hived, will usually induce them to remain when discontented.

But should you discover the bees running to and fro in great commotion, although quiet at the entrance, you should lose no time in sprinkling those outside with water. They will instantly enter the hive to avoid the apprehended shower. In half an hour they will be ready to start again, during which time the others may be secured.

When any of the subsequent swarms are disposed to unite with those already hived, throw a sheet over to keep them out. An assistant is very useful at such times; one can watch symptoms, and detain the swarms, while another hives them. Occasionally, when waiting for a swarm to start, two may do so simultaneously. Whenever a part was already on the wing, I never succeeded in retarding the issue; it is then useless to try to drive or coax them back. To succeed, the means must be applied before any part of the swarm leaves. Two or more swarms will cluster together and not quarrel, if put into one hive.

SEPARATING SWARMS.

Spread a sheet on the ground, shake the bees upon the center of it, and set an empty hive each side of the mass; if too many are disposed to enter one hive, set it farther off. They should be made to enter rapidly. There are even chances of getting a queen in each hive. The hives should now be placed twenty feet apart; if each has a queen, the bees will remain quiet, and the work is done; but, if not, the bees in the one destitute will soon manifest it by running about in all directions, and when the queen cannot be found, will leave for the other hive, where there are doubless two; a few going at a time. In this case set the queenless portion one side, turn the remainder out upon the sheet, and let them enter as before, keeping watch for the queens, which indeed should be borne in mind from the beginning. As the number of bees is much lessened, the chances of seeing the queen are

good. When one is found, secure her, and put with those without one. Should you fail to find a queen, and be unable to make a division in consequence, or resolve to let them remain together, it is unnecessary to put them in any larger hive than usual; but boxes should be immediately put on, which should be changed for empty ones, as fast as they are filled.

SWARMS RETURNING TO THE OLD HIVE.

Occasionally a swarm will issue, and in a few minutes return to the old stock. The most common cause is the inability of the old queen to fly, on account of her burden of eggs, or imperfect wings. I have sometimes, after the swarm had returned, found the queen near the hive, and put her back; and the next day she would come out again, and fly without difficulty, probably having discharged some of her eggs.

Sometimes a swarm will issue and return three or four days in succession, but this may generally be remedied, as it is often owing to some inability of the queen; and she may frequently be found while the swarm is leaving, outside the hive, unable to fly. In such circumstances, have a queen cage ready and secure her as soon as she appears. Get the empty hive for the swarm, and a large cloth, and put down a bottom-board a few feet from the stock. The swarm is sure to come back, and the first bees that alight on the hive will set up the call. As soon as you perceive this, lose no time in setting the old stock on the board at one side, covering it with the cloth. Put the new one in its place on the stand, and the queen in it; in a few minutes the swarm will be in the new hive, when it can be removed and the old one replaced.

AFTER-SWARMS.

After-swarms are all that issue after the first, called second, third, etc., for convenience. Whenever, in a

prosperous season, the first swarm is not kept back by foul weather, the first of the young queens in the old colony is ready to emerge from the cell in seven or eight days. The second swarm may be expected in about two days thereafter. On the morning of that day, or the evening previous, by putting your ear close to the hive, and listening attentively a few minutes, you will hear a distinct piping noise like the word "peep," uttered several times in succession, and followed by an interval of silence. Two or more may be heard at the same time; one will be shrill and fine, another hoarse, short, and quick. These notes are probably never heard except when the hive contains a plurality of queens. I never failed to hear it, previous to any after-swarm, whenever I listened.

PREVENTING AFTER-SWARMS.

A very decided improvement in practice, for those who have hitherto allowed their bees to swarm at will, is to permit but one swarm to issue. As this will, in an average season, give a satisfactory increase, and furnish more or less surplus, it will, to many, prove a desirable method. I shall therefore give directions for preventing after-swarms. When the first swarm issues, hive it as just described. Twenty-four hours later, open the hive from which it came, and remove all the queen-cells. Smoke the bees thoroughly, and introduce a laying queen, as directed in Chap. VIII. Examine the hive a few days later, to ascertain if the queen has been accepted, when, if no queen-cells have been overlooked, swarming will usually be ended for the season.

Another method which I prefer, is to prepare a nucleus, as elsewhere mentioned, in the hive which is to receive the swarm. With this method, the queens should first have their wings clipped. When the swarm starts, go to the hive, and watch for the queen. Her wing being

clipped, she cannot fly, and can easily be found. Put her in a queen cage, a supply of which should always be at hand. As soon as the bees have all issued, remove the old hive from the stand and put a new one in its place, covering it with the same roof, to identify the spot, and place the caged queen at the entrance. Carry the old hive to the stand occupied by the nucleus, and put it in its place. Open the nucleus, find and cage the queen, and place her in the old hive between two combs. Next shake all the bees from the nucleus in front of this hive, and take these combs to the old stand, and if the work has been done so quickly that the swarm has not yet commenced to return, place these combs at the center, or, better, alternate them with empty combs. As the swarm returns, release the queen, and permit her to enter with the rest. The queen in the other hive may be liberated the next day. Care must be observed that the bees do not enter adjacent hives, which will frequently happen. Several light sheets should always be at hand to spread over such hives as they may attempt to enter.

When bees leave the hive in swarming, they seem to relinquish all claims to the old location. I have known them to enter several adjoining hives. They are usually readily accepted at such times, as they are filled with honey. The practice of clipping the queen's wings, and hiving swarms thus, is advocated by some, for the assigned reason that if several swarms issue at the same time, they would separate and return to their respective hives, thus saving much trouble. With this, my experience does not coincide, particularly if the bees attempt to alight, which two or more swarms together are much more likely to do. Such are quite apt to all return to one hive, and usually to one of those from which they issued, yet these too, will often scatter, and enter different hives. This I offer as an objection to this plan. As it is essentially the same in result as the first method suggested in

"Artificial Increase," I advise those who can do so, not to allow them to fly.

I recommend these latter methods, for those who feel incompetent to judge of the proper time to make swarms. In the latter case, the occurrence of swarming determines the period for the operation, while in the former, the bee-keeper must select the colony, and use his discretion as to whether it is in condition to furnish a swarm. By observing the indications of the queen cells, it is easily seen if a swarm will soon be ready, and it may be made artificially, thus avoiding the annoyances mentioned as occurring when they are allowed to issue in the natural way.

ARTIFICIAL INCREASE.

Those who wish to increase their colonies by the best methods, and avoid the perplexities of natural swarming, will do so by dividing, or as otherwise termed, making artificial swarms. It is impossible to state the precise date when this increase can be most profitably made, as it will vary in different seasons and localities, as well as in individual stocks in the same apiary. Increase in quantity of bees, should at all times be borne in mind, but when it is wise to increase swarms, is quite another matter. I maintain that it is never best to divide, until all weak colonies have been built up to a proper standard, by taking brood from stronger ones. If the bee-keeper is so fortunate as to possess none but good swarms, he may add combs from time to time, so that, at the proper period for boxing, or dividing, there may be a larger number of combs spared from the old stock. Often it is more desirable to occupy the colonies to the best advantage in this way, than to increase them earlier. When colonies are populous, and honey plenty, it is safe to divide. There are various practicable methods, but after careful trial, I shall advise but two. The first is this: In the middle of a fine day, when the bees are busy at work,

place a new hive near the colony to be divided. Open the old hive, smoke the bees slightly, take from it six frames without shaking the bees from them, and place them in the new hive. Leave the two center combs in the old hive, as well as the old queen. Fill the empty space with frames of empty worker combs, or foundation. Remove the new hive to another part of the apiary, where a hive has been arranged as hitherto explained, with one or two combs, a few bees, and a laying queen. Cage the queen, smoke these bees thoroughly, and place the six combs taken from the old hive in this one. Put the caged queen between two combs in such a position that she will have access to sealed honey, smoke all well, and close the hive. Twenty-four hours after, open it, using smoke, and liberate the queen.

Mr. H. Alley, of Wenham, Mass., one of the most successful queen breeders in the country recommends smoking with tobacco, when uniting bees, and introducing queens. While I do not approve of the use of tobacco smoke as a rule, I appreciate the benefit of having the bees pervaded with the same scent, and also of their being more completely subdued for the time. If the nucleus has not been prepared beforehand, to supply the laying queens, one may be purchased, and the swarm be made ready on her reception. This mode of increase indicates that each strong colony may with safety furnish one good swarm, in ordinarily favorable seasons, and many times, the new colony formed, as well as the old one, may each give yet another.

But in view of the lack of uniformity in the seasons, some being so poor, as in 1869, that not even the very best stocks are able to secure food for brood-rearing—the second mode is much preferable, as it is equally practicable whether the increase is to be extensive or limited, as desired, or as the yield may warrant.

It is premised that a number of hives to receive swarms

have been prepared as nuclei, and each contains one or two combs with a queen, and a small quantity of bees. When the colony becomes populous, and honey is gathered freely, a comb containing sealed brood may be removed, and replaced with empty comb or foundation. Shake the bees from this frame in front of the hive, allowing such young bees as cling to it to remain, and make room for it in a nucleus by moving the division board farther to one side. If the weather continues favorable, examine the old colony two or three days later, and if the last comb added is found to be filled with eggs and honey, another comb of brood may be removed and added to the nucleus. If there are several stocks from which increase is to be made, a comb may be taken from each simultaneously; but if six or seven are thus taken at one time, and united to fill a hive where a queen and but few bees are in waiting, the queen should be first caged, and the old bees carried with the combs, instead of being shaken off as before directed, as a larger quantity of bees than the nucleus contains will be required to cover and care for so much brood. Always be sure that the queen is not on the combs thus removed. In a few days after this colony is formed, another may be made from the same stocks. The queen should be released in twenty-four hours after the swarm is made, always using smoke freely at such times. The advantages of this method are apparent. If honey-gathering should suddenly cease, as sometimes happens, no partly filled hives will be on hand, as when all but one or two combs are taken from the old hive. I recall one occasion when I divided several colonies in May, giving each part four combs and four empty frames. Bad weather supervened, and in fact little honey was gathered during the entire summer, and I was obliged to unite the divided colonies to bring them to a proper condition for winter.

STRAIGHT COMBS.

A consideration worthy of notice in regard to the frames filled with new combs during these operations, is, that if the new one be built between two that are true and straight, it must itself be perfectly straight. Frequently, where several frames are filled with foundation, the cells in one will be built longer at the top than those on the one opposite, making them fit less exactly when their position is changed. This plan of dividing is recommended as efficacious in preventing the desire to swarm.

CONTROLLING SWARMING.

Many bee-keepers prefer surplus honey to increase of stocks. This is often the case with those who keep but one or two swarms, to supply honey for home use. Those who pursue bee-keeping for profit, in sections where the honey yield is brief in duration, find that, as a rule, the less increase made, the greater the gain in surplus. But in other sections, where the yield is prolonged, it frequently happens that stocks may be doubled, and more honey secured from each of the two, than would have been produced by the old stock, with a gain of the new colony besides. As the apiarian can not know in advance what the duration of the honey harvest will be, we who have short seasons must practice a system of management which is suggested by the idea that the less increase the better, provided the desire to swarm is controlled.

NON-SWARMING HIVES.

With this idea in view, many hives have been devised and devices suggested, all of which have been partial failures. Probably the New Quinby Hive attains this end as nearly as any, but it has never been claimed to be a complete non-swarming hive. Its facility for furnishing

abundant box-room when limiting the number of frames, constitutes its chief merit in this direction. The ability to control the desire to swarm will be found in the methods to be practised, rather than in any particular form of hive or mechanical device.

METHODS.

It is evident that swarming may be prevented, and yet the course pursued be very unsatisfactory. For instance, a colony that had made fine progress in boxes, became very populous, and attempted to swarm. I cut out all queen-cells, and removed the queen. Now, I certainly was master of the situation, as they did not attempt to swarm again, until nine days later. But the amount of work done in storing honey during this period, was inconsiderable. The bees clung to the hive, seemingly waiting until a queen could be reared to lead out a swarm. On the ninth day I again removed queen-cells, and introduced a young, prolific queen, with clipped wing. I closed the hive, and walked to another part of the yard, when I turned and saw the swarm issuing. I caught the queen as she came out, and caged her.

Knowing that it would be undesirable to let them return to the old hive, I removed it to a distant stand and put a new hive in its place, to which they might return. This hive was furnished with empty frames, and the young queen again given them. An hour later they made another attempt, this time with the evident purpose of leaving the vicinity, but finding that the queen did not accompany them, again returned. I mention this instance to show the necessity of action before the desire to swarm is developed. I think the experience of many will coincide with my own, that, as a rule, if hives are properly ventilated and shaded, with plenty of room for surplus, and openings to boxes free and immediate, and am-

ple space afforded the queen to deposit eggs, the impulse to swarm will usually be held in check. Colonies with young queens are not so apt to endeavor to swarm. For ten years past I have extracted honey largely, taking it by the ton each season (excepting 1869), and I have never had a stock attempt to swarm which was extracted regularly each week. This indicates some of the conditions necessary to control the tendency to swarm. But where hives are boxed, the problem is a more perplexing one.

DEPRIVING OF A QUEEN.

There is a practice advocated which is based upon the fixed principle that a swarm will not issue, and found a new colony, without a queen. Consequently, if a hive is made queenless at the beginning of the swarming season, no swarm can issue until another queen is in some way supplied. If, on the ninth day after the queen is taken away, all queen-cells are removed, the brood will be so far advanced that other queens cannot be reared, and the colony will remain destitute until the apiarian supplies the deficiency.

I have practised this method to quite an extent, but there are such evident disadvantages in it, that I cannot recommend its general adoption, at least, by the inexperienced. Under suitable circumstances, there are benefits to be derived from it by the skilful apiarian, where several apiaries are located at a distance, and absolute control of each swarm is important, without the necessity of constant supervision. Another point in its favor is, that swarms can be controlled with less labor.

SUGGESTIONS.

Were I to have an apiary under my immediate supervision, and desire to obtain the best possible yield of honey, in sections like Central New York, I should al-

low no increase of swarms. I would select the best half of my stocks for boxing, as from such, box-honey must be secured, and extract from the remainder, observing the rule to "keep each hive supplied with a laying queen." In removing cards of brood from those that were boxed, and replacing them with foundation, to prevent swarming, I would furnish them to the hives being extracted. This plan will be found satisfactory in seasons when the yield is light. If, in a productive season a moderate increase is wanted, the last course recommended in Artificial Increase, should be adopted. Just the number of combs that should be taken from each colony, and the frequency of the operation, to prevent swarming, will depend materially upon circumstances, and demand some experience and close observation. The rule is, that an incomplete comb must occupy the center, directly in front of the entrance.

Occasionally, a refractory colony will persist in a pertinacious attempt to swarm. I have often met this emergency by changing its place at mid-day, when all were working rapidly, with one that was being extracted. If there is no such colony, and a light one is found that does not take possession of the boxes, I exchange with that, often benefiting both. Remember always, that this must not be done, except during rapid honey-gathering, as it would endanger the safety of the queen. At other than such times it may become necessary to remove larger quantities of brood from such colonies, and supply empty combs or foundation. Otherwise, it is sometimes well to remove the boxes, and furnish combs for extracting.

HINTS FOR EXCEPTIONAL SEASONS.

Four seasons ago (1875) our honey harvest was very short; swarming was decidedly unprofitable. Usually but one swarm issued, and in such instances both

old and new swarms scarcely stored enough honey for winter. In my own apiary I prevented all swarming, and in some cases, used cards of brood from one swarm to build up others. This was simply making one aid in fitting the other to gather surplus, that could not be otherwise secured during such an unfavorable period. The thoughtful bee-keeper may often turn such meager yields to profitable account by skilful and judicious management. If, by a little forethought and study, even one-half the usual amount be secured, the demand is increased by the scarcity, and the price is proportionally better, so that the income will not be so much reduced as may be supposed. It might be well indeed to diminish the number of colonies in such emergencies, by uniting, and thus increase the working capacity of a less number to marked advantage.

CHAPTER X.

BOXING AND SURPLUS HONEY.

PUTTING ON BOXES.

There is no operation connected with the care of bees that requires more experience and careful observation, than that of putting on and taking off boxes; for, to decide upon the precise time when boxes are needed, involves a nicety of judgment which long experience only can give. The proper date for supplying boxes will vary with the climate, strength of colonies, and yield of honey. While yet inexperienced I made serious mistakes in placing boxes upon my hives too early in the season. In this immediate section, the time when boxes will usually be needed upon the best swarms, occurs soon after raspberry and clover begin to bloom. If, before the opening of the

above mentioned blossoms, swarms are populous enough to occupy boxes, I find it advantageous to take cards of brood from them and exchange for empty combs in weaker swarms. Or, when there are facilities for adding an indefinite number of frames, as with the Quinby hive, I occasionally add an empty comb to the center of the brood-nest, which the queen will soon fill with eggs; and in this way increase the force of working bees. I frequently add combs from time to time in this manner, until I have 10 or 12 frames containing brood in very many hives.

As six combs are all that the hive requires when boxed, I remove all above that number, leaving only such as are well filled with brood, and then arrange the boxes in place. These surplus combs are of value in dividing colonies for increase, or for adding to hives designed for extracting, as directed in Chap. XI. If done at the proper time, the brood-chamber being diminished in size, and the remaining combs filled with maturing brood, the bees will at once enter the boxes and commence storing honey. If we desire box-honey to present the most attractive appearance, it is essential that the boxes shall not be furnished until the bees are ready to begin work at once, and will fill them rapidly. If they are on too long beforehand, the bees are apt to round off the unfinished edges of the guide combs, and are more reluctant to begin work upon them. The number of boxes required will depend upon the strength of the colony and amount of forage. It is quite important that the bee-keeper can estimate the probable duration of the honey yield, as it draws to a close. When the first set of boxes is removed, they may be replaced with empty ones, but great care should be exercised not to add too many. It is quite a common error, even with experienced apiarians, to add boxes so late in the season as to be obliged to remove them when but partly filled, and badly soiled. These unfinished

combs are of value as guides in boxes the ensuing season. They may be removed from the boxes, the capping cut, and the honey taken out with the extractor. The bees should be allowed to have access to them, that they may remove all honey adhering to the cells. These combs need to be protected from dirt and dust. I advise, however, that but a limited number of boxes be placed upon the hive, that all may be filled, and then devote the remainder of the season to securing new combs in the body of the hive, for use as guides. When built in frames they may be more readily extracted, and the soiling of boxes avoided. Or, if an extra supply of combs is desired, foundation may be furnished for the bees to build out for future use. If this is not desirable, empty combs may be added for extracting, or to be filled and reserved for the following season's operations, as suggested in the Chapter on Extracting. It is, of course, profitable to prolong their work in boxes, as long as they will complete them handsomely.

I usually put the first set of boxes on the top of the hive, and when partly filled, remove them to one side of the combs, and place a fresh set at the top. If the swarm is strong, and the flow of honey continues, these may be put at the other side in like manner, and the top refilled. If only a top-boxing hive is used, the first set may be raised before completion, and empty ones placed beneath, with holes in both top and bottom, to permit the free passage of the bees. With swarming restricted, I have had thirty-two five-pound boxes upon several hives, in the entire number of which bees were so freely at work as to complete twenty-four of them at nearly the same time. Do not entertain the idea that all swarms will gather such amounts. It will frequently occur that some swarms will not occupy all the boxes furnished, or they may discontinue work before they are completed. These may often be removed, and given to such colonies as will

be likely to finish them. Many bee-keepers meet this emergency by feeding extracted honey of good quality very freely, thus stimulating the bees to renewed exertion. Directions on this point will be found in the Chapter on Feeding.

One of the prime essentials in boxing is ease of access from the body of the hive. It is true, that when boxes are very accessible, the queen will at times enter them, and deposit eggs therein, yet the advantages of this proximity are so great that this objection is more than counterbalanced. Where but few brood-cells appear, they may be removed, but if nearly filled with brood, the boxes should be placed where the bees may hatch and enter the hive. The honey-board as mentioned in connection with the use of two-comb boxes should not be more than $^1/_4$ in. thick. One reason why so little box-honey can be secured from box-hives, lies in the fact that the bees must pass through holes in the top of the hive, which is generally an inch thick.

REMOVING BOXES.

All boxes should be promptly removed as soon as full. Thus the boxes will not be soiled, and the delicate whiteness of the combs will be unsullied by the frequent passing of the bees over them. I prefer to perform the operation in the middle of the day, for they then contain the fewest bees, but it may be done at any time. Place the box near the entrance of the hive, and tap it gently a few times, when the bees will usually all leave it. If any bees are indisposed to leave, and there are large numbers of boxes to be cared for, they may be arranged in a pile, so that all bees can escape, in a closed room, and a caged queen placed in a nucleus box among them, when they will all gather with the queen. In bringing home large quantities of box-honey from apiaries away from home, I have often in this manner preserved bees that lack of

time would not allow me to remove before leaving the yard. These may be utilized by making a nucleus for queen-rearing, or strengthening some weak stock. With the section box that is not glassed before being filled, there is little trouble in removing the bees, as they may be easily shaken or brushed off. The smoker is particularly serviceable in these various operations with boxes.

CARE OF BOX HONEY.

At this busy season, when the time of the bee-keeper is so wholly occupied, the honey must be cared for as quickly as possible, and placed where it may remain until it is to be prepared for market. As each box is taken from the hive, it should be examined to ascertain if any cells contain bee-bread. Such boxes should be kept by themselves, where they may be looked to frequently, as moth-worms are much more liable to be found in them. Honey should be kept in a dry, cool, dark room. If it could be located on the north side of a building, where the sun's rays would not strike it, it would be preferable. When packing away, let the boxes occupy the same position, vertically, as when upon the hive. If the room is cool, there will be little danger of injury from the larvæ of the moth, yet it should be occasionally examined, and if any are found, let them be removed at once. If they are discovered between combs, where they are not accessible, they may be destroyed by the fumes of brimstone.

Put the boxes, with the holes open, in a close barrel or box that will confine the air as much as possible. Leave a place for a dish, in which to burn some sulphur matches made by dipping paper or rags in melted brimstone. When all is ready, ignite the matches, and cover closely for several hours. A little care is necessary to use the right quantity; too little will not kill the larvæ, and too much injures the color of the combs. In making the

matches, much less sulphur will adhere to paper, when it is very hot, than when just above the temperature necessary to melt it.

If it were not for the fact that the moth-larvæ are much more liable to be troublesome, it would be beneficial to keep box-honey in a moderately warm room, as a higher temperature would facilitate its perfect ripening.

Mr. G. M. Doolittle approves of placing it in a room, on the sunny side of the house, where it will be subject to a high temperature. He arranges his boxes on a rack designed for the purpose, so that the fumes of brimstone, which he burns in the room, will come in contact with every comb. The heat of the room will soon advance the brood of the moth. This plan has some special features to recommend it, as it does not involve an examination of the boxes to ascertain their condition. Besides, it practically rids them of all moth-eggs, so that none are left to hatch and make their appearance after the honey passes into the dealer's hands.

PRESENCE OF LARVÆ.

The question is naturally suggested at this point, "How does the moth get into the box to lay her eggs?" I cannot answer this better than by quoting Mr. Quinby's words: "I have taken off glass jars of honey, and watched them until the bees were all out, and was certain the moth did not come near them; then, immediately sealed them up, absolutely preventing any access, and felt quite sure that I should have no trouble with the moth-larvæ. But I was sadly mistaken. In a few days, I could see a little white dust, like flour, on the side of the combs, and bottom of the jar. As the larvæ grew larger, this dust was coarser. By looking closely at the combs, a small, white thread-like line could be perceived, enlarging as the larvæ progressed. The reader would like to

know how they came in the jars, when to all appearance, it was a physical impossibility. I would like to give a positive answer, but cannot. I will offer a theory, however, which is original, and therefore open to criticism. If there is any better solution of the problem, I would be glad to hear it. From the 1st of June until late in the fall, the moth may be found around our hives, active at night but quiet by day. Her only object, probably, is to find a suitable place to deposit her eggs, where her young may have food. If no proper and convenient place is found, she will be content with such as she can find. The eggs must be deposited somewhere, and she leaves them in the cracks of the hive, in the dust at the bottom, or outside as near the entrance as she dare approach. The bees running over them may accidentally attach one or more to their feet or bodies, and carry them among the combs where they will be left to hatch. It is not at all probable that the moth ever passed through the hive, among the bees, to deposit her eggs in the jars before mentioned. Had these jars been left on the hive, not a larvæ would have ever defaced a comb; because, when the bees are numerous, each one is removed as soon as it commences its work of destruction—that is, when it works on the surface, as it does in the boxes. By taking off these jars, and removing the bees, all the eggs that happened to be there had a fair chance."

SUGGESTIONS FOR SECURING CHOICE SPECIMENS OF HONEY.

It is often desirable to secure some very choice specimens of honey, for exhibition or other special purposes. As the suggestions given will also indicate some points that will be useful in general practice, they may be of value to all beginners. The first consideration is to select a time when that class of blossoms which produces the

finest honey, furnishes a profuse supply. In this section, this bloom would be basswood. Next, the fact that when honey is gathered and combs constructed most rapidly, the appearance is most superior, indicates that a vigorous colony should be chosen.

For reasons given in Chap. II., native bees should be selected, if box-honey is to be produced; and Italians for extracted. A new, clean hive should be prepared, and the frames supplied with full cards of foundation. Let this hive take the place of the colony chosen; then shake all the bees into it. Neatness in and about the hive is very important. Do not allow the bees even to pass over an old and soiled alighting board, but give them a new one. If dust is flying to any extent, brush it off of the board frequently. The effect upon the color of new combs when built between old and dark combs, is more than would at first be supposed. I have had full cards of new combs built with great rapidity in this way, when they were too dark to be used as guides in boxes. In preparing boxes, observe perfect neatness, and use the purest white comb for guides, not more than 2 inches $\times 1^1/_2$ inch in size. Worker comb will present the finest appearance. If all the requirements have been attended to, the foundations will be drawn out in 48 hours, sufficiently to warrant putting the boxes in place. If to be extracted, the combs will soon be ready to empty.

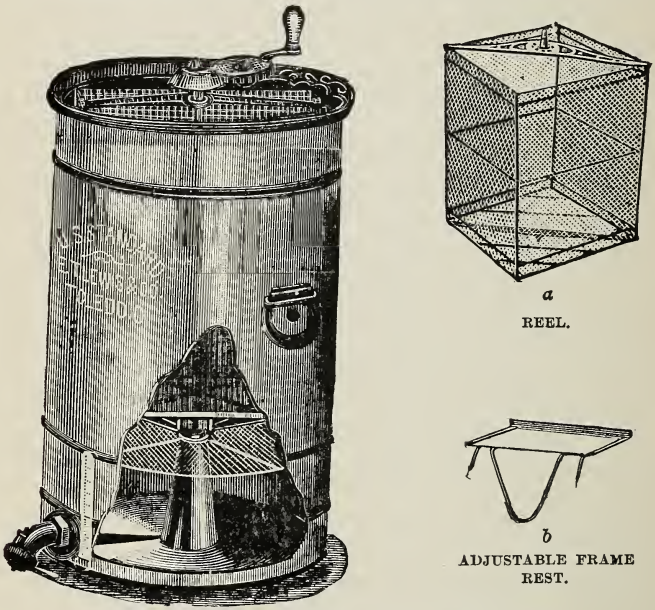
Where the brood-nest may be reduced at pleasure, I should limit the space so as to crowd the bees into the boxes; as they should commence work as soon as they have access to them. The boxes should be removed as soon as filled. The care and neatness here inculcated will, if habitual, have a perceptible effect upon the appearance and reputation of the products of our apiaries.

CHAPTER XI.

THE HONEY EXTRACTOR AND ITS USE.

ITS VALUE.

Second only in importance to the invention of movable frames, is that of the machine for extracting liquid honey from the combs. It was invented by Herr Hrus-



a
REEL.

b
ADJUSTABLE FRAME REST.

Fig. 67.—UNITED STATES STANDARD EXTRACTOR.

chka, of Germany, in 1868. The simple words, "centrifugal force," solved the problem, and taught us all how short a step it often is from obscurity to light. Mr. Langstroth had a glimmering of it, ten years before, when he wrote, "If store combs could be made of gutta percha, they might be emptied of their contents, and re-

turned to the hive." Without the movable frame, it would be impracticable to extract the honey, and without the honey extractor, some of the most important results from the use of movable combs, would be lost. I deem the extractor an absolute necessity in every well conducted apiary, and great honor is due to him who first demonstrated its practicability. The principle of the honey extractor I am glad to say, is unpatentable in America. There are several forms now in use, some of which are patented, but these are in no material feature superior to those that are not patented.

DESCRIPTION.

The principle upon which the extractors operate, is essentially the same in all. A reel is made (see fig. 67, *a*,) of a suitable size for the frame to be used, around which tinned wire-cloth of one-quarter inch mesh, is tightly stretched and securely nailed. A can of heavy tin, with a stout iron band around the top to strengthen it, is made large enough to hold the reel, allowing about one-inch play between it and the can. There should be at least 4 inches space beneath the lower part of the reel, at the bottom of the can, to hold the honey. A honey-gate is attached to the lower part of the can. A gearing and crank are attached to give the reel the required motion.

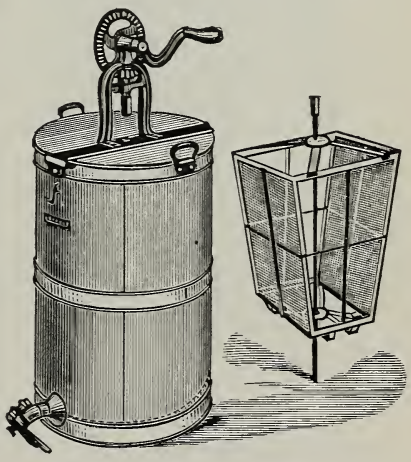


Fig. 68.—MUTH'S HONEY EXTRACTOR.

The reel is fitted into a socket at the bottom (fig. 67, *a*.) A comb rest (see *b*, fig. 67), is useful to hold small pieces of comb, when it is desired to extract less than whole cards. There are two modes of gearing, flat and upright, the first of which is shown in fig, 67. The figure is an illustration of the U. S. Standard Extractor, made by E. T. Lewis & Co., Toledo, Ohio. The upright gearing (fig. 68) is equally practical and much preferred by some. The best of this class is manufactured by C. F. Muth, Cincinnati, Ohio, who deserves credit for many desirable features in this extractor.

STANLEY'S AUTOMATIC EXTRACTOR.

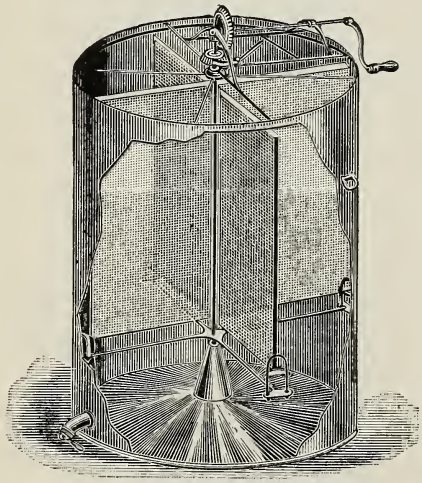


Fig. 68, *a*.—STANLEY'S AUTOMATIC HONEY EXTRACTOR.

G. W. Stanley & Brother, of Wyoming, N. Y., are perfecting an extractor which they claim will turn the combs in the reel without the aid of the operator, as their position is changed by the motion of the revolving frame (see fig. 68, *a*). This is a valuable feature in an Extractor, and one of which we have long felt the need.

THE USE OF THE HONEY EXTRACTOR.

The extent to which the extractor should be used, will depend much upon the market for extracted honey. If the demand was for both box and extracted honey, I should furnish both. Bee-keeping can be conducted very

satisfactorily where all the surplus honey is taken with the extractor. In fact, I should much prefer this method of securing the surplus, if consumers demanded it. This system is much better adapted to all kinds of seasons than that which involves boxing. By it, swarming may be easily controlled, and if the season closes more abruptly than is expected, the annoyance of a great number of incomplete boxes is avoided.

Brood rearing is continued more extensively late in the season, in hives that have been extracted, consequently such hives are found to contain a larger supply of young bees when put in winter quarters. I have taken both box and extracted honey largely from the same apiary, for several years, when the conditions were, in all respects, equally favorable to the production of both, and have had ample opportunity for noting results.

WHEN TO EXTRACT.

It is seldom necessary to use the extractor until the general honey yield commences. The honey furnished by the early blossoms, including that from apple, and other fruit bloom, is usually required for breeding. If occasionally a hive contains too much honey, there will be others so light that combs should be exchanged. There may be instances where they were so heavy in the fall, and the bees consumed so little during winter, that to facilitate brood-rearing, it would be necessary to extract the honey from the center combs in order to make room for the deposition of eggs.

ARRANGING HIVES FOR EXTRACTING.

If we are to receive the best returns for the labor and outlay expended, it will be necessary to supply the swarms to be extracted with extra combs. If the hanging-frame hive is used, an extra hive should be filled with

combs, and placed beneath the colony (fig. 69). For holding these hives together, the fastener illustrated in fig.

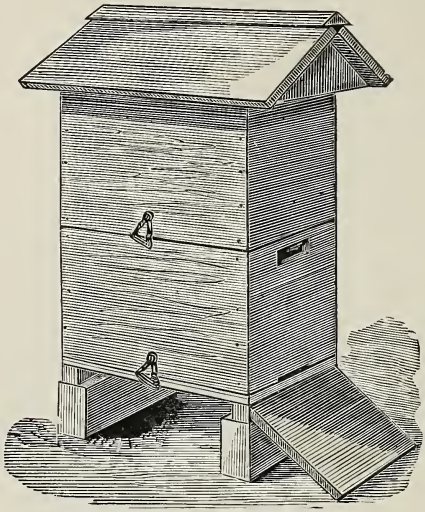


Fig. 69.—A TWO-STORY HIVE.

70 is very useful.* In the new Quinby hive we can place 16 combs side by side. I have reached satisfactory results with both kinds of hive. In case no extra combs

Fig. 70.—VAN DEUSEN'S CLASP.

are available, frames containing foundation must be added as fast as the bees will complete them, until the required

*This was invented by C. C. Van Deusen, and is an excellent device for securing hives to the bottom-board, and for many other purposes. When not in use it may be turned back against a screw-head, when it will be entirely out of the way, as indicated in fig. 70.

number is obtained. This indicates the wisdom of employing the bees, at intervals when their labor is not directed towards surplus, in building such combs for future use, as elsewhere suggested.

HOW TO EXTRACT.

If one or two empty frames are at hand, place them in an empty hive. Remove the hive to be extracted from its stand, and put this empty hive in its place. Open the hive that has been removed, find and cage the queen, and place her in the empty hive on the old stand. Now shake and brush the bees from the combs in front of the empty hive, and take the combs to the room where the extracting is to be done. With the honey knife, remove all capping from both sides, where the honey is sealed over. The knife must be drawn from heel to point, in order to cut the capping off smoothly, and avoid bruising the ends of the cells. After all the cells are uncapped, place two or four combs in the extractor, as it may hold, and turn it with sufficient speed to throw out all the honey. When the cells on one side are emptied, reverse them and extract the opposite side. Proceed in this way until all are emptied. Honey may be thrown from the most tender combs without injuring them. When extracting from old combs, we get no pollen or anything but the pure honey, thereby avoiding the impurities incident to old fashioned strained honey. The inexperienced should carefully observe the speed requisite to throw out the honey, and where there are brood-combs, avoid turning fast enough to dislodge the brood.

Some writers claim that it is not practicable to extract combs which contain any brood. I have practised it freely, and when it is done judiciously, I see no harm resulting, while several desirable ends are accomplished. I do not wish any honey that has been in the hive one

winter to remain sealed, and to be kept over until another winter; thorough extracting will avoid this. Brood-rearing is stimulated by extracting the brood-combs. Such combs in the brood-nest as are designed for winter stores, should not be extracted too late in the season, as late-gathered honey is not usually so desirable for winter consumption. In changing hives, as hereafter directed, and extracting all the combs, a marked advantage will be derived in the expulsion and destruction of every moth-worm. In uncapping honey in brood-combs, use care not to disturb the cells containing brood. A little caution is all that is necessary, as the honey-cells are usually lengthened out more than the brood-cells.

After the combs are all extracted they should be arranged in the hive in the same order as before. If still more hives are to be extracted, this hive may be used, in the process of changing, as above alluded to. Remove the next hive to be operated with, put No. 1 in its place, and shake all the bees before it, when they will enter, and work with even more energy than before the operation. Extract the combs from this, and proceed to the next in the same manner. When the round is completed, place the last hive and its contents upon the stand of No. 1, now occupied by an empty hive and bees, shake the bees into it, and release the queen.

In extracting, I notice the condition of each colony. If the first one is populous, containing a large amount of brood, I select for the second, one that has less bees, as in this way the brood furnished them, will place them in better condition. The next swarm selected, should be more populous, and so on. This equalization benefits all, giving the weaker ones more working force, and the better ones more room for stores. When the general harvest begins, I prefer that all the honey then in the hive be extracted and kept by itself, thus preventing all mixing of light and dark honey. A little care in observing the

cessation of the yield from different kinds of flowers, will enable the apiarian to keep different qualities of honey separate, the advantage of which is self-evident.

CURING EXTRACTED HONEY.

Much has been said against the practice of extracting what is termed unripe honey. It is maintained that the honey must remain in the combs until well cured and capped over. I have refrained from committing myself on this point, until I could speak from years of experimental knowledge. I have extracted honey in every stage, from that which was gathered the same day, to that which was sealed over; and I shall advise extracting honey before it is sealed. Much labor is saved to the bees, in not being obliged to cap the cells, and the operator is spared the trouble of uncapping them. If the honey is properly cared for, it will be found to be equally fine, without regard to the ripeness when extracted. Curing honey simply means a proper evaporation of the water it contains. This is accomplished in the hive by its being subjected to a high degree of temperature before it is sealed. The same result may be produced, by maintaining similar conditions, after it is extracted. I have extracted honey in wet seasons, when it was unusually thin, and found it necessary to place the cans in artificial heat, until it was sufficiently evaporated.

Honey is very often injured by being stored in a wooden cask or pail in a damp place. It should be kept in tin, or, if in wood, the vessel should be first coated inside with wax. The process of coating casks is given in Chapter XVI., on Marketing Honey.

Honey should always be kept in a dry room. If stored in a cask which has first been coated with wax, the hole through which it is filled should be left open. For some years, I have marketed my extracted honey in tin cans.

When taken from the extractors, it is strained through a thin cloth, into a tin vat with a large faucet at the bottom. All specks rise to the top, and the shipping cans are filled by drawing the honey through the gate at the bottom. Honey may be more thoroughly cured by passing over an evaporator as shown in fig. 71. The evaporator is so constructed that the surface over which the honey passes, is heated by water raised to a proper temperature, which should not exceed 140°.

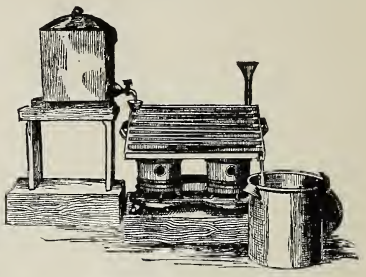


Fig. 71.—EVAPORATOR.

HONEY KNIFE.

In 1870, we extracted very extensively, and in using the straight honey knife or uncapping knife, which up to that time was the only one in use (fig. 72), we found that for rough and uneven combs, as well as for rapid execution upon smooth combs, it was not of the most convenient shape. During that season, we experimented to some extent with knives bent in a great variety of forms, which resulted in the invention of the curved-pointed honey knife (fig. 73). The fact that so many have adopted it; (some so cordially as to endeavor to make themselves and others believe that they originated it), is ample proof of its

Fig. 72.—STRAIGHT HONEY KNIFE.

Fig. 73.
CURVED-POINTED HONEY KNIFE.

merit. Those who are familiar with its history will remember that the first curved-pointed honey knives that appeared in market, bore the stamp of "Quinby and Root."

SECURING EXTRA COMBS OF HONEY.

Extracting as well as boxing should not be carried on too late in the season. The honey gathered in the fall, is generally of inferior quality. When less honey was produced, and the price was good, the poorer qualities would sell at fair rates; but, now, that the production is increased, it must be of superior quality and offered in an attractive shape to command fair returns. I mention this to show that the later and poorer qualties of honey may be secured in suitable shape, and be of more value to the bee-keeper in the care of his bees, than if sold at reduced prices. To this end, then, cease extracting sufficiently early, and supply hives that are boxed, with empty combs, after boxes are filled with white honey. These extra combs, when filled with the inferior grades of honey, may be placed in a dry, cool place, and preserved for the following season's use. They will be found valuable in many operations, especially as suggested in the Chapter on Feeding.

SECURING GUIDE COMBS.

I often wonder where we formerly obtained guide-combs for our boxes in sufficient quantity, and of suitable quality, without the use of the extractor. I have practised placing two empty frames in each hive, one at each side of the brood-nest, and find that they will be filled each week.* When extracting, I remove these combs, and supply their place with empty frames. After

* I am satisfied that the young bees secrete wax, and build combs at times when they would otherwise be idle, making this a very economical method of securing guides.

extracting the honey from them, I place them where the bees will thoroughly clean them of honey, and then pack them away in a dry, cool place, where they will not become soiled. They may be placed in a box of suitable size, with a door in the side, under a swarm, and should be removed as fast as cleaned.

In Chapter X., on Boxing, another mode of securing guide combs is mentioned. I desire particularly to call attention to these practical methods, to show that with a little forethought, there is no necessity for using foundation in surplus boxes.

RELATIVE AMOUNT OF BOX AND EXTRACTED HONEY.

It is claimed by some that we may expect to secure twice as much extracted honey as box honey. This may be true in some cases, but when extracting a large number of hives, I think it not safe to expect over one-third or one-half more. The price that each quality commands will determine which it is most profitable to produce.

CHAPTER XII.

WAX AND COMB.

WAX.

During the summer season, when honey is being gathered rapidly, and combs must be constructed in which it may be deposited, the observing bee-keeper will notice scales of wax upon the under side of the abdomen of the bee, as seen in fig. 74. Wax is a natural secretion of the honey-bee and, as has been demonstrated by many of our most able apiarians, may be produced by feeding honey or syrup, even when the bees are confined to the hive. These scales are detached from the body with the

Fig. 74.

claws, and after being suitably moulded with the jaws of the bee, are used in the construction of honey-comb.

HONEY-COMB.

Nothing in the domestic economy of the bee-hive is better calculated to impress the observer with the wonderful instinct of the honey-bee than the process of comb-building. The ingenuity which the bees display in the fashioning of the delicate cells might well put human skill to the blush. Mr. Quinby says:

"They need no lectures on domestic economy to tell them that the use of the base of one set of cells, on one side of the comb, for the base of those on the opposite side, will save both labor and wax; no mathematician, that a pyramidal base, with just three angles, and just such an inclination, is the exact shape needed, and will take much less wax than if round or square, that the three-angled base of one cell, forms a part of the base of three other cells on the opposite side of the comb, that each of the six sides of one cell, forms one side of six others, that these angles and these only would answer the ends required."

The first rudiments of comb will often be found within the first half hour after a swarm is put in an empty hive, and I have seen bits of wax—as large as a pin's head, on a branch, where a swarm had been clustered for a less time than that. The first deposition of wax for the commencement of a comb seems to be much at random, until sufficient material is accumulated to begin the cells. While the combs are in progress, the bases of the cells near the edge are always kept much the thickest, and are worked down as they proceed. The edges of the cells, when completed, will always be found much thicker than other parts. When bees are allowed to build their combs without interference, they are quite unlikely to make

them as straight as is desirable; and even when in frames a sharp edge, or guide, is furnished, they will need some attention to make them carry the combs straight to the bottom. The rapidity with which comb will be built, depends upon the temperature of the hive and amount of honey being gathered or fed.

SIZE OF CELLS.

Practically, all cells built for brood-rearing are assumed to be precisely of the same size, but close observation and measurements prove that there is a slight variation. This is so minute, however, that it does not materially affect the average number of cells to the square inch, which, in worker-combs, is 25 on each side. The diameter of worker-cells, therefore, averages about $^{1}/_{5}$ of an inch. The depth is $^{7}/_{16}$ of an inch. Drone cells are larger, so that four will about measure an inch, or 16 to the square inch. Their depth, when used for breeding, is about $^{9}/_{16}$ of an inch, but they are often much deeper when used for storing honey.

Where drone and worker cells are built on the same comb, the joining of cells of different sizes will produce considerable irregularity, as may be seen in fig. 2. Even where two combs, with cells of the same size, unite, they are often quite imperfect. Queen cells are of exceptional size and shape, and are constructed according to the especial needs of the colony, and it is quite frequently the case that a large number are never completed. (See fig. 66.)

HEXAGONAL SHAPE NOT ESSENTIAL.

The introduction of comb-foundation and experiments with artificial comb, have resulted in a more thorough understanding of the essential size and form of cells. The shape of the natural cell is evidently determined more by considerations of economy, strength, and space, than by

the inherent necessities of the bee. It is proved by actual experiment that a cell with a flat base is equally as practical as that with the three-angled base, constructed by the bee ; and I am confident that a round cell of suitable dimensions would answer their real wants as well as a hexagonal one.

COST OF COMB.

The cost of comb in labor and material is largely underestimated. The amount of honey required to secrete a pound of wax, is generally thought to be not less than 15 lbs., and some assume it to be as much as 25 lbs. Admitting that no more than 15 lbs. is used, this expenditure is a sufficient argument for the exercise of careful supervision of the construction of combs, that none be built to a manifest disadvantage, as well as, that no part shall be allowed to go to waste.

ARTIFICIAL COMB.

While an artificial comb, with cells of the full depth, and practical in all respects, has not yet been offered for our consideration, I must express my belief that such will yet be made. In 1870 Mr. Quinby experimented largely in this direction, and although complete success did not crown his efforts, he established some curious and interesting facts. He succeeded in manufacturing combs of very light tin, as follows : Strips of tin were cut $^{7}/_{16}$ inch wide, and passed between two rollers (fig. 75), which were so constructed as to crimp the tin into the exact shape of a half cell.

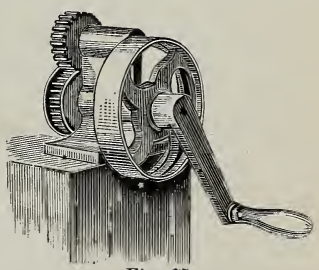


Fig. 75.
MACHINE FOR METALLIC COMB.

These strips were placed together, as shown in fig. 76. It will be seen that two opposite sides of each cell were composed of two thicknesses of tin. A sheet of this same light tin was used to form the flat base of the cells. After both sides were fitted, and secured, the whole was dipped in hot wax, and was then ready for use. The first piece tested was about four inches square, and was placed in the center of a frame of worker-comb, by cutting a hole of the desired size and fitting it in very exactly, so as to present an even surface. This was placed at the center of the cluster, where the queen occupied it, filling it with eggs, just as she did the natural cells adjoining; and in due time the young bees matured in both equally well. There were manifest advantages in combs so constructed. Worms certainly could not injure them and disturb the bees and brood; but after thoroughly testing them, it was evident that the weight and expense of such combs would render them impracticable. The fact was demonstrated, however, that bees would accept and occupy combs of foreign material. The practicability of the flat base, as now used in comb-foundations, was here fully established. Combs were also made of very thin sheet-iron, untinned, and were readily occupied, for both honey and brood. The fact that these metallic foundations were not obnoxious to the bees, was advance proof of the practicability of incorporating wire in wax foundation as since invented, and demonstrated by J. E. Hetherington.

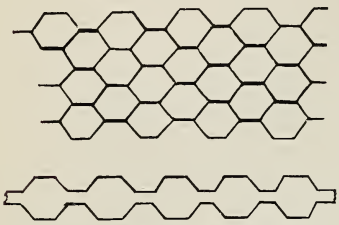


Fig. 76.—MANNER OF SETTING UP METALLIC COMB.

Another interesting item in these experiments was this. The first comb was made with cells $^1/_2$ an inch deep. When the brood was sealed over in these cells the caps

were placed precisely $^1/_{16}$ inch from their ends, thus showing the exact depth of natural cells. It was also curious to notice how readily the bees would lengthen the artificial cells with wax, when they were used for storing honey. In nearly every instance they were extended enough to allow them to be uncapped with the honey knife for extracting. These experiments are quite sufficient to incline me to the already expressed belief in the future success of complete artificial comb.

SUPPLYING MATERIAL FOR COMB.

The amount of honey and labor involved in the construction of natural comb, as previously indicated, shows the extreme desirability of, in some way, utilizing refuse wax, by converting it into perfect comb again, rather than to dispose of it at 30 cents per lb. It has often been noticed that, in warm weather, bees would bite off bits of wax from fragments of comb, and carry them into the hive to use in comb-building. I have been, for a long time, convinced, as I have since demonstrated, that this process might be facilitated by furnishing the wax in some feasible way. I have placed tender cappings, that had been taken from new combs when extracting, in feeders, where the bees had free access to them, at a time when they were building out foundations, and the wax so furnished was speedily appropriated by the bees and used in the completion of the combs.

COMB–FOUNDATION.

It is difficult to understand why comb-foundation has received so little attention during the twenty or more years, since it was first brought to notice by our German friends. Prof. Cook states that the Germans first manufactured it in 1857, by merely pressing sheets of wax between flat, metal plates, stamped in such a way as to

simply leave the impression of the bases of the cells, without any start whatever, of the side-walls; and he considers this to be the extent to which they carried the work. This is corrected by E. Kretchmer, of Coburg, Iowa, who writes in the "American Bee Journal," of December, 1878, as follows: "Comb-foundations were made in Germany in 1842 by my father; they were made by a pair of engraved rollers, and starch was used to prevent the wax from adhering to the rollers." This statement is corroborated by Mr. Kretchmer's "Guide Book," published in 1868. The improvements which brought foundation into general use in America, are accredited to Frederick Weiss. A modern comb-foundation machine consists of two rollers so accurately engraved that by passing thin sheets of wax between them, not only the base of the cell is formed, but also the rim or beginning of the side-walls.

Comb-foundation has of late been receiving the careful attention of many skilled workmen and thorough manufacturers.

In the construction of machines for making foundations with the natural or hexagonal base, I think I am justified in saying that in perfection of workmanship, J. Vandervort, of Laceyville, Pa., stands at the head. His machine for making a light quality of foundation, shown in fig. 77, is acknowledged to be the most perfect one for the purpose ever made. He claims it to be the only machine that will make foundation with natural base as light as twelve square feet to the pound. Messrs. Dadant & Son, Hamilton, Ills., who are high authority, as they unquestionably manufacture the best grade of natural base foundation in America, use it in preference to any other.

I feel certain that the heavy grades of this make for brood frames will also take a prominent position. Mr. Vandervort deserves patronage from the fact that while

he gives us a better machine, he also gives us a cheaper one.

Mrs. Frances Dunham, of De Pere, Wis., is the inventor of a machine which is at present very popular for making foundation for brood combs. It is believed by many to be the best heavy foundation machine ever made.

Mr. A. I. Root, of Medina, Ohio, has done good work in his way in bringing foundation into public notice.

Mr. Pelham, of Maysville, Ky., has made a foundation machine which differs somewhat in construction from others, and has desirable features.

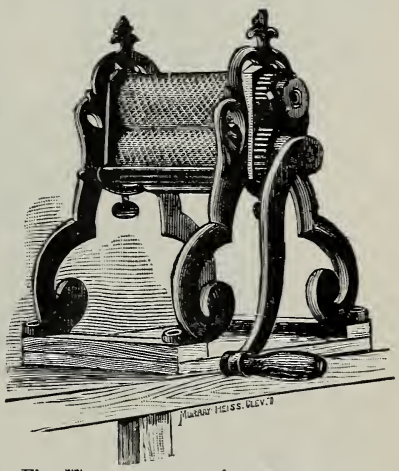


Fig. 77.—VANDERVORT'S COMB FOUNDATION MACHINE.

D. S. Given & Co., Hoopeston, Ills., have invented a machine upon a somewhat different principle from all others, called the "Given Foundation Press" (see fig. 78.) This kind of foundation is thought by some to be especially fine, and the Press is coming into quite general use.

FLAT-BOTTOM FOUNDATION.

The construction of this foundation is such that it can be much more easily made in large sheets than that with hexagonal base. The manufacturers can furnish it both light and heavy in sheets 15x30 inches, or larger, which cannot be claimed for any other make of foundation.

The form of the base of the cell also makes it more practical to incorporate the fine wire which is used in

some of it. It can be made lighter than the natural base, and yet have the wires well covered with wax. Figure

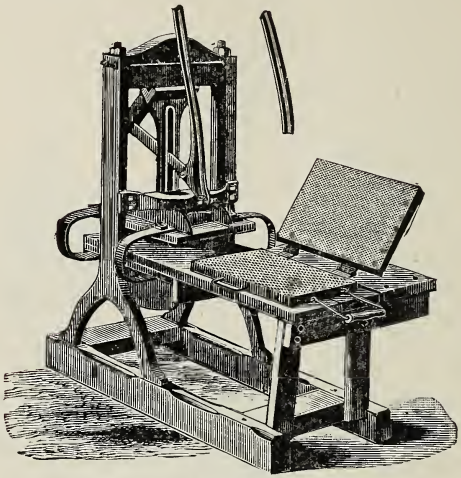


Fig. 78.—GIVEN FOUNDATION PRESS.

79 shows a machine for making foundation of this kind. Comb-foundation has been so much improved that the

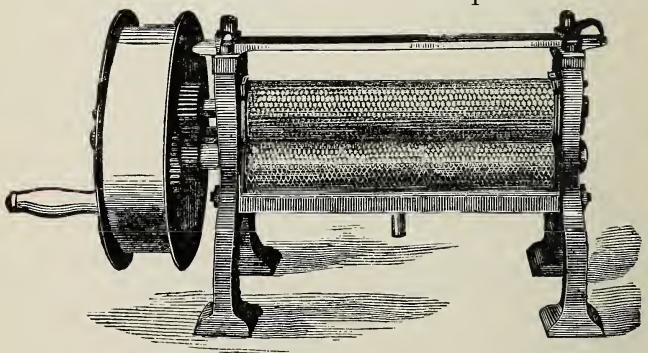


Fig. 79.—MACHINE FOR MAKING WORKER-COMB FOUNDATION.

liability of sagging is much diminished, yet in extremely warm weather, and under certain circumstances, it will sag.

To obviate this many consider wire essential. I esteem foundation thus supported, valuable from the aid the wires give the completed combs, rendering them less liable to be broken from the frames while handling. Flat bottom foundation and the process of incorporating wire (see fig. 79, *a*) were invented and patented by Capt. J. E. Hetherington, the well-known and extensive apiarian, and is now controlled by J. Van Deusen & Sons, Sprout Brook, N. Y., who are the sole manufacturers.

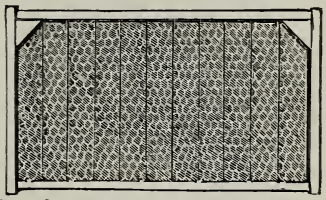


Fig. 79, *a*.—FOUNDATION WITH WIRES.

USES AND VALUE OF FOUNDATION.

Foundation would be valuable, if only used as guides in frames, as it would be a means of securing straight combs. But its full worth is best appreciated, when complete frames of it are put into the brood-nest. The value of full cards of perfect worker-comb cannot be over-estimated, and in no other way can they be so economically produced. We are also able to entirely control the quantity of worker-comb, and exclude drone-comb at pleasure. The value of foundations in hastening the increase of bees, is apparent. Those without a supply of empty combs, may, during the spring months, use foundations to advantage. I have, when transferring, thus filled up a desired number of frames and placed them in the center of a strong colony when apple-blossoms were yielding honey. In 48 hours, the cells were drawn out, and filled with eggs. It is clear that the value of the bees reared in such combs, in advance of those that could not be matured until natural combs were built, would more than equal the cost of the foundations.

If honey is being gathered rapidly, I should pronounce good foundations at such times, superior to empty combs.

If the cells are complete, the bees are more apt to fill them with honey, thus limiting the space of the queen for egg-laying; but as foundation cells are drawn out, she will occupy a larger proportion of them, during the process. If drone-combs are desired for extracting, or other purposes, drone-comb foundation may be procured.

FOUNDATION IN SURPLUS BOXES.

Many advocate the use of comb-foundation for guides in boxes. It is manufactured for this purpose, of a very light weight. I have samples before me, so delicate that 16 square feet weigh but 1 lb. I have, from the outset, opposed the use of anything artificial in honey boxes, and receive daily proof of the soundness of my position.

Prof. Cook's remarks upon this subject in his "Manual," are pertinent and wise. He says, "It will not be well to have the word 'artificial' hitched on to our comb-honey. I think it exceedingly wise to maintain inviolate in the public mind, the idea that comb-honey is, *par excellence*, a natural product."

While I think there are good reasons for adhering to the stand taken above, I must consider fairly the points in favor of using foundation in this way. That a larger amount of honey can be secured by its use is indisputable. That the combs built in boxes in which full cards of foundation have been placed, are much handsomer cannot be denied. Another advantage is that the foundation gives strength to the comb, which enables us to ship it with more safety. While these are undeniable facts, the truth in my own position as above alluded to, as well as in that of Prof. Cook, is worthy of consideration. Time alone can determine the ultimate result.

TO FASTEN FOUNDATION IN FRAMES.

Foundation may be secured by laying the end of the sheet on the under side of the top bar, and nailing upon

it a thin strip of wood, one-half as wide as the bar, even with one edge of it, so that when the frame is raised to an upright position the foundation will turn down against the strip, and hang directly in the center of the frame. C. C. Van Deusen says that he finds it practicable with the wired foundation to cut off with a pair of wooden shears about $^1/_4$ inch of the edge of the sheet that is to go next to the top-bar. The shears will only cut away the wax, and leave the ends of the wire exposed. He bends these ends to a right angle with the sheet, and glues them to the bar in the proper position. I consider the latter method the best. Foundations to be placed in frames should be cut so that they will come within $^1/_8$ inch of the sides, or $^1/_4$ inch of the bottom. I cut them most satisfactorily by laying a thin board of the required size upon the sheets, and cutting around the edge with a sharp knife. After a little experience this method is rapid and easy.

Foundation is easily fastened in boxes with white glue. Several machines have been invented for securing foundation in both frames and surplus boxes, which promise to be extremely satisfactory. There is no doubt of their becoming indispensable in a very short time. The best known of these implements are "Parker's Machine," and "Goodrich's Foundation Fastener." I should have been very much pleased to illustrate these, if space had permitted.

RENDERING WAX.

The ordinary process of rendering wax as hitherto practised, has not only been vexatious, but wasteful, and I shall, therefore, pass it unnoticed, and give the more convenient and economical methods. The most approved plan is by the use of a wax-extractor. The first one I shall describe is a foreign invention, which was first made

by Professor Gerster, of Switzerland. The usual size of this is as follows: A can is made about one foot high, and the same in diameter, with suitable lid and handles. The bottom consists of a shallow basin or pan, similar to a pie-tin, made about 1 inch smaller than the can, with a rim 1 inch high. This is fastened near the bottom of the can, with arms, in such a manner that it stands at the distance of half an inch from all sides of the can, with one side a little elevated, so that the melted wax will run to one side, where a small tube or spout passing through the side of the can, is inserted to carry it off. A basket of wire-cloth or perforated tin is made 1 inch smaller than the shallow bottom, and high enough to reach nearly to the top of the can. Three bearings are arranged on the inside of the bottom, upon which the perforated basket may rest, at a distance of $^1/_2$ inch from the bottom, and all sides of the can. This completes the extractor, which is shown in figure 80. To render wax in this extractor, place it upon the stove, over a kettle partly filled with water, in the same manner as an ordinary kitchen steamer. Fill the perforated basket with the refuse comb or wax, cover tightly with the lid, and place a pan under the spout to catch the wax as it runs out. As fast as it melts, more may be added, until all is rendered.

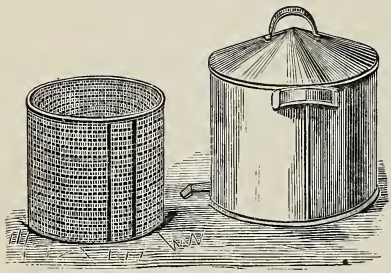


Fig. 80.—SWISS WAX EXTRACTOR.

The latest and best wax extractor which has been brought to my notice was invented by D. A. Jones, of Beeton, Ontario, Canada. I have tested it very thor-

oughly and I like it the best of any extractor that I have ever used. (See fig. 81).

In moulding wax into cakes, use a deep basin, and when cool. if any impurities are found upon the bottom,

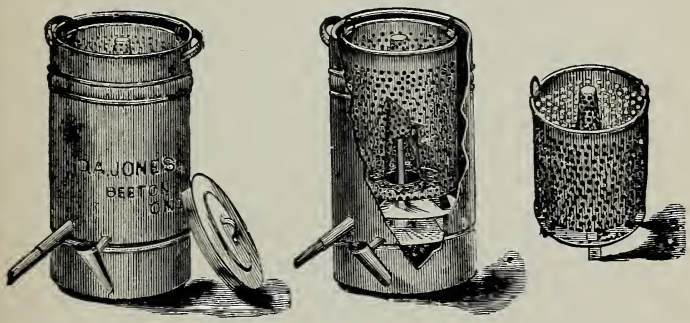


Fig. 81.—JONES' WAX EXTRACTOR.

shave them off, and melt this portion again. Combs designed for this purpose should be cared for often enough, to prevent the worms from getting in and spoiling them. The extractor is a convenient utensil for holding all bits of refuse wax, and fragments of comb. Dippers, pans, and other implements used in rendering wax, become coated with it, and are not easily cleaned.

CHAPTER XIII.

FEEDING.

ITS NECESSITY.

The subject of feeding bees is, latterly, receiving more attention than has hitherto been deemed essential. It may be easily demonstrated, that with intelligent management in the best locations, and most favorable seasons, no feeding is necessary.

In 1869, our stock of bees numbered 415 swarms, and the exigencies of the season were such, that when it was over, only six colonies had enough honey to carry them through the winter, and one-half of the whole number had none at all. We fed 5,500 lbs. of honey and sugar, for the winter, besides what we gave them during the summer, to keep them alive, no honey being gathered, except from apple-blossoms. This was the most disastrous year for bees, in Mr. Quinby's experience of forty years. Between this extreme, and that of not being obliged to feed at all, the necessity for supplying food will vary with the season.

In 1874, I found feeding necessary from May 1st, until July 20th, before bees gathered honey enough to continue breeding profitably. And yet, after this date, I took an average of 100 lbs. of honey per hive, from my entire apiary, numbering 100 colonies, besides increasing the number to 119, and securing stores enough for winter. Here was an instance of a season opening very unfavorably and closing prosperously.

The year 1875, presented exactly the reverse in many sections. From the first honey-gathering in spring, brood-rearing was stimulated by a moderate supply, and when the general yield began in July, the combs of best

stocks were filled with brood. So well were they occupied, that there was no room for storing honey, except in boxes, and the amount of surplus was large, considering the season. This result was largely due to the measures adopted, as given in the Chapter on Increase. Fall forage entirely failed, and the consequence was, that when the combs were vacated by the brood, there was no honey to be gathered to fill them for winter, and the requisite supplies had to be furnished by feeding. It often happens that brood-rearing will progress finely during the time of apple-blossoms, between which and clover, etc., a period of scarcity will occur, when feeding will be absolutely indispensable. During cold and stormy days, when bees cannot go out for water or honey, feeding is essential.

WHAT TO FEED.

A good quality of honey, is undoubtedly good enough. Yet the continued experiments of our best bee-keepers, have given abundant proof that good sugar is equally suitable, and by some is claimed to be even better than honey. I have used it largely, comparing the results with honey fed at the same time, and find it to be satisfactory. As feeding occurs when honey is scarce, sugar is much less liable to induce robbing, making it in this respect much more desirable to use. The poorer grades of honey sell so low, that it is often cheaper to feed such honey than to purchase sugar for the purpose. Besides, the impurities and adulteration of sugar, at the present day, are making it quite undesirable.

We are tending more and more each year to the practice of feeding honey only, to our bees, and I shall welcome the day when this will be the exclusive practice, thus avoiding the appearance, even, of any possibility of fraud in the quality of our surplus honey.

Grape sugar and glucose have been advocated as a cheap

food for wintering bees, and stimulating breeding, but my experience coincides with that of many of our best bee-keepers who condemn their use entirely. For wintering, it has proved an entire failure with me.

PREPARING FOOD.

As bees require water when rearing brood, the food furnished them at such times should contain more water than when it is to be sealed in combs for winter stores. Honey should be diluted by adding 1 pint of water, to 4 pounds of honey; the mixture should then be scalded and skimmed.

To prepare sugar, add 1 quart of water to 3 pounds of "A" sugar, bring to a boil, and skim. In selecting sugar, avoid such as contains impurities. That with a bluish tint is objectionable, as it often contains a foreign substance that will be found in the form of a sediment at the bottom of the vessel after dissolving it. We used large quantities of sugar thus adulterated, in the spring of 1876, and the great loss of bees which followed, was evidently the result of some deleterious substance in the sugar. For fall feeding, when it is to be stored in the combs for winter use, honey need not be diluted, and the sugar syrup may be made with one quart of water to 4 pounds of sugar.

FEEDERS.

It is very necessary that feeders be so arranged that the bees have easy access to them, from the hive, and also, that bees from other hives shall not be attracted to them. A cheap and very practical feeder, which I use in connection with the Quinby hive, is shown in fig. 82; it is a simple tin cup, 3 in. deep, 5 in. long, and 2 in. wide. These

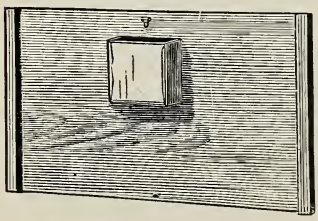


Fig. 82.—FEEDER ON PANEL.

dimensions can be varied to suit. In the center of one side, near the top, is a $^3/_4$-in. hole, and near each end, on either side of this hole, are two others, large enough to slip over a nail-head.

In the panel, at the side of the Quinby frame, I bore a $^3/_4$-in. hole to correspond with the one in the cup, and drive two small nails at proper distances each side, upon which to hang the feeder. A cap may be made to shut out bees from the outside. I lay a piece of glass over it, to be able to see when it is empty. These feeders are coated on the inside with a mixture of shellac and sand, that the roughness may give the bees a footing. A float is made of $^1/_8$-inch board, and $^1/_4$ inch smaller each way than the inner dimensions of the feeder. Across the underside of this, at each end, is a cleat $^1/_4 \times ^1/_8$ inch. This is nailed on with small tacks just long enough to clinch. If, in each end of the cleats, a tack is driven partially in, so that the head comes within $^1/_8$ inch of the cleat, the float will rest upon the heads of these tacks when the feeder is about empty, and the bees will be able to pass under it. This will allow the bees to remove the food more completely than if it rested directly on the bottom. The fact should always be borne in mind, that bees should never have access to liquid honey, without something being placed in it to sustain them.

The feeder above described, can be used in connection with the hanging-frame hive, in the spring, when each swarm contains but a limited number of frames, and a close-fitting division-board is used to economize space. A hole may be bored in this board, and the feeder adjusted as above.

For feeding at the top of the hive, I know of nothing better than the Van Deusen feeder (fig. 83). After filling, it is inverted and placed over the opening on the top of the hive. Atmospheric pressure prevents the escape of the honey or syrup. If adjusted properly, the feeder

will prevent the escape of heat from the hive, and at the same time it occupies a warm position, which will aid the bees in securing the food. A very practical feeder may be made in a frame, and placed directly in the hive. We have arranged a bracket upon which this feeder may be placed. Locke's New Bee Feeder was invented by S. M. Locke, Salem, Mass., and has some desirable points. It is considered by many to be one of the very best feeders lately invented, (see fig. 83, *a*).

Where extensive feeding to supply winter stores is necessary, a more rapid process is advantageous. We have practised putting the syrup or honey directly in the

Fig. 83.—VAN DEUSEN'S FEEDER.

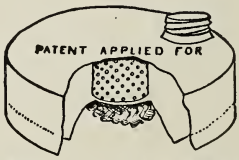


Fig. 83, *a*.—LOCKE'S FEEDER.

combs with satisfactory results, giving the entire amount necessary at one time. It may be done as follows: Take a can or tub about two feet across the top, in which place the syrup made as above directed. Then prepare a board a little wider than the depth of the frames, by nailing a strip on each edge, which shall project about one inch above it, to prevent the liquid from running off the sides of the board, and to conduct it back into the tub. Place one end of this board on the tub, and the other upon legs elevated enough above it so that the feed will run off freely (see fig. 84). Then in the bottom of a common quart-dipper, punch one-sixteenth inch holes, about three-eighths of an inch apart. Place the empty comb on the board, and dip up the syrup, letting it drain into the

cells. A little practice will indicate the distance it must fall, as there must be force enough to drive it to the bottom of the cell, and not so much as to cause it to spatter out. In turning the combs to fill opposite sides, care should be taken, or they may fall out of the frames. To prevent this, use a piece of thin board, the size of the frame, placing it under it while filling, and raise the comb with it to an upright position, and then place the board on the opposite side, and fill as before. As fast as

Fig. 84.—FILLING COMBS FOR FEEDING.

the combs are filled, set them up perpendicularly, where the extra syrup may drain off. These operations must be performed in a room where bees can make no trouble. Combs filled with syrup must be placed in the hives after the bees stop flying at night. After the required amount is put in the combs, it is well to weigh the whole again, to see that nothing is lost by robbing. If some hives are found to contain more than the necessary amount, heavy combs may be exchanged for light ones from other hives. One writer, in endorsing this method, approves of it,

"because it saves the bees the labor of putting the honey in the cells." But this is an error. The bees evidently remove it, and re-store it, probably to exclude the air, and secure a more thorough evaporation of the water.

HONEY IN COMBS FOR SPRING FEEDING.

A colony should never be without sealed honey during spring months. It is much easier to ascertain the presence of such honey than that of uncapped honey. The last sealed honey in a comb will usually be at the top. By using a smoker, the bees may be driven from this part of the combs, and the amount of capped honey observed, without disturbing the frames. Any deficiency thus discovered may be supplied by furnishing combs of sealed honey, preserved for the purpose the previous season, as has been elsewhere suggested. I anticipate the extensive adoption of this plan of feeding. To stimulate breeding, it will only be necessary to break the capping of such combs by rubbing the edge of a knife over them, when the bees will remove the honey.

FEEDING TO SECURE SURPLUS IN BETTER FORM.

The practice of freely feeding extracted honey, to be stored in boxes, is becoming quite common. If a suitable time is chosen, and the weather is warm, it will be found advantageous when boxes are partly filled, and would not be otherwise completed. Strong colonies should be selected for the purpose, and should contain only such combs in the brood-nest, as are well filled with brood and honey, and but a limited number of frames. They should be fed as rapidly as they will appropriate the honey. For this purpose, a large feeder should be used. One holding at least 10 pounds would be preferable.

HONEY SHOULD BE WARM WHEN FED.

Honey should never be taken from a cold room to feed, unless first warmed, especially when fed for storing in boxes. It should be as warm as when gathered by the bees in midsummer. This matter of temperature, and of feeding in the morning so that honey may be taken into the hive during the warmest hours of the day, have an important bearing on successful feeding, for storage in boxes.

Mr. Quinby and myself experimented largely in feeding in quite cold weather, by arranging the hives inside of a room, on the principle of the House Apiary, and furnishing artificial heat. While the experiment was not perfectly successful, we proved the practicability of using artificial heat when feeding, and for other purposes connected with the House Apiary. When feeding to stimulate breeding, about one gill should be given regularly each evening. The bees should not be fed any more than they will consume, as it is undesirable to have syrup stored in the combs, at this season. In feeding for winter use, food may be given them as rapidly as they will store it. It is important that this be done early enough in the fall, to be properly sealed in the combs. In this latitude, it will be necessary to do it in September, or early in October. The greatest care must always be exercised in feeding, not to expose honey in any way, and thereby induce robbing.

Since writing the above, I have experimented largely in feeding the different grades of sugar, and I attain the best results in using the lower grades. I much prefer the yellow "C." It seems to contain essential properties not found in the more refined grades.

CHAPTER XIV.

ROBBING.

GENERAL REMARKS.

Robbing is often a source of loss to the careless apiarian. It is frequent in spring, and at any time in warm weather, when there is a scarcity of honey. It is very annoying, and is sometimes a source of contention among neighbors, when perhaps neither is to blame, farther than for ignorance. The person keeping the most bees, must expect to be held accountable for all the losses in the neighborhood, whether they occur from mismanagement, or want of management, and if he escapes without being charged with those losses due to hundreds of causes, he ought to be thankful. It is often thought if a person has but one stock, and another has ten, that the ten will combine to plunder the one. This conclusion is not warranted by facts; I can discover no collusion between different families of the same apiary. It is true that when one colony finds another weak and defenceless, possessing treasures, they have no conscientious scruples about carrying them off to the last particle, notwithstanding that they revel in abundance at home; and it is most frequently the case that the strongest colonies are most given to this despicable habit. The hurry and bustle attending the plunder, seldom escape the notice of other hives, and when one hive has been robbed, perhaps two-thirds or all of the other colonies have participated in the offence.

When honey is being gathered largely from natural sources, little apprehension of robbing need be entertained. At such times honey may often be left exposed, without receiving the slightest attention from the bees. We have taken tons of honey with the extractor, in the open air, when it was most freely exposed, without exciting their

marauding propensities in the least. But if such temptations are placed before them in times of scarcity, particularly in the spring, serious results may be anticipated. It is worth while to mention here, that if thievish habits are formed early in the season, by careless exposure of even trifling quantities of honey, bees will search for it more perseveringly, during the season, if it prove to be a poor one, than if, by strict care, they had been prevented from acquiring the habit. Therefore, it should be a cardinal rule, for beginners, that honey, or broken up, discarded hives and frames, upon which particles of honey may remain, should not be accessible to the bees, at any time when they could possibly be demoralized thereby. Robbing is often induced by leaving too large an entrance open, or other unnecessary apertures, thus allowing outsiders too free access.

Probably but few bee-keepers are able to know at once when bees are robbing. It requires the closest scrutiny to decide. There is nothing about the apiary more difficult to determine; nothing in which one is more likely to be deceived. It is generally supposed that when a number are fighting outside, it is conclusive that they are also robbing, which is seldom the case. On the contrary, a show of resistance indicates a strong colony, and that they are disposed to defend their treasures. A very weak colony of Italians will often make a spirited resistance. I have no fears for a stock that has courage to repel an attack. The greatest danger is with those weak colonies incapable of opposition. Such should at all times be closely watched, and the entrance more than usually contracted, that the bees may the more easily defend themselves. Queenless colonies are much less vigorous in self defence. If there are colonies which have been wintered on their summer stands, or having been set out earlier in the season are thoroughly established, in the same or neighboring apiaries, care should be taken in setting out

weak swarms, as in the confusion incident to the first flight they are in less defensible condition, and much more likely to attract pillagers than they will be later in the season. Let it be understood that all good stocks, under ordinary circumstances, will take care of themselves. Nature has provided them with the means of defence, with instinct to direct its use.

INDICATIONS OF ROBBING.

In order to recognize the first indications of robbing at a glance, it will be necessary for the bee-keeper to be able to distinguish between old and young bees, and between those that are filled with honey and those that are not. Each robber, when leaving the hive, instead of flying in a direct line to its home, will turn its head towards the hive to mark the spot, that it may return for another load, in the same manner that bees do when leaving their own hive for the first time in the spring. When the young bees first leave home, they mark their location in the same manner. A few of these begin to hatch very early, in all good stocks, often before the weather is warm enough for any to leave the hive. These young bees will fly out very thickly about the middle of each fair day, or a little later. This unusual activity strongly resembles the bustle of robbers, and it is difficult to detect the difference. Their motions are alike, but there is a little difference in color, the young bees being a shade lighter; and the bodies of the robbers, when filled with honey, are a little larger. But while one is learning these nice distinctions, his bees may be ruined. Bees, when they have been stealing honey from a neighboring hive, will generally run several inches from the entrance before flying; kill some of these; if filled with honey, they are robbers; for it is very suspicious to be filled with honey when leaving the hive; or, if there are but few colonies,

mark the bees, sprinkling some flour on them as they come out, and let some one watch at the other hives to see if any of those with flour on them enter. The following is less trouble, but it will be longer before they are checked, if robbing. Visit them again in the course of half an hour or more, after the young bees have returned, and if the bustle continues or increases, it is time to interfere. When the entrance has been contracted, as directed, close it entirely until near sunset. If it has been left open, it should now be closed, giving room for only one bee at a time. This will allow all that belong to the hive to get in, and others to get out, and will materially retard the progress of the robbers. Unless it should be cool, they will continue their operations until evening. This late working, by the way, is a good test of robbing. Visit the hives each warm evening, as they commence depredations on the warmest days, and seldom at any other time. If any are at work when honest laborers should be at home, they must be regarded with suspicion.

REMEDIES.

The old saying, "An ounce of prevention is worth a pound of cure," is most applicable here. To keep stocks strong and capable of self defence, is the golden rule that would carry the beginner over these critical periods, when scarcity of honey and a little undue carelessness on his own part tempts the "busy bee" to take what he wants wherever he can find it. But in the best regulated apiaries we shall find colonies that need special care. When the mischief is begun, prompt measures must be instituted. Mr. Quinby says: "I would recommend removing the weak hive on the morning after the attack to the cellar, or some dark, cool place, until two or three days have passed, and the search has been abandoned. The robbers will probably attack the stock on the next stand.

Contract the entrance of this according to the number of bees to pass. If the colony is strong, no danger need be apprehended. When a hive has been removed, if the adjoining one is weak, take that in also, to be returned as soon as the robbers will allow it. If a second attack is made, put the hives in again, and let them remain until the marauders cease their attempts. When robbers are endeavoring to effect an entrance into a hive, a little grass, or what is better, some asparagus tops, thrown loosely before the opening, will afford material hindrance, and when the attack ceases, it may be removed."

I may add to these suggestions that when stocks are put in the cellar for protection, they may be entirely destitute of stores, which deficiency must be supplied by feeding.

CHAPTER XV.

DISEASES AND ENEMIES OF BEES.

DYSENTERY.

If proper conditions for wintering be observed, this disease need not be feared. If honey is gathered late in the season, or is fed so late as not to be sealed up, it will tend to produce dysentery. A cold, damp cellar, where bees are unable to properly evaporate the moisture in their food, and undue disturbance, will also have the same tendency. A genuine case of dysentery can be produced in a very short time by combining these conditions. It may be detected by the soiling of the hive about the entrance. The combs will also often be soiled and injured. The bodies of bees thus affected will be found to be unusually distended. When in this condition they should be allowed to fly, on the first favorable opportunity, in order that

they may discharge their fæces. The wise bee-keeper will observe suitable precautions, and prevent the appearance of this evil.

FOUL BROOD.

During a large portion of Mr. Quinby's bee-keeping experience, the evil of foul brood held so decided a foothold among the apiaries of American bee-keepers, that his time and attention were, for many years, greatly engrossed by its investigation. He was among the very first to become familiar with its appearance, his first observations being made as early as 1835. In the first editions of this work, he gave a minute account of his investigations into the cause or causes of the malady, and search for a preventive; and, although he never satisfied himself as to the cause, his persevering efforts in seeking remedies were rewarded with admirable success. In later years, and particularly since the introduction of Italian stock into this country, the disease has abated so materially as to be of minor importance. Our last experience with it was in 1870, and its final disappearance was somewhat remarkable, inasmuch as it seemed to vanish without any special effort on our part for its extinction. Several stocks that were somewhat infected, were marked to identify them, and placed in winter quarters, with the design of breaking them up in the spring; but when removed from the cellar all traces of the disease had vanished, and the stocks remained healthy thereafter. I have seen but one case of foul brood since, and that a mild one.

INDICATIONS OF FOUL BROOD.

The cappings of the infected cells are somewhat sunken, with a small hole in the center. The disease only affects the immature brood before it reaches the chrysalis state. By an examination of the brood-cells it is easy to ascer-

tain if any of the larvæ be dead and putrid. Healthy larvæ are always white, until some time after they assume the chrysalis form; hence, if they are dark-colored, it indicates something wrong. Where the malady has made much headway, the unpleasant odor is ample evidence of its presence.

REMEDY.

The first thing to be done is, to confine the bees in an empty hive or box, set them in a dark, cool place, and let them remain there, at least twenty-four hours, that all the honey they carry with them, may be entirely consumed. There is no doubt but the honey from an infected hive, will carry the contagion to a new stock of brood. After sufficient time has elapsed to prevent this danger, the bees may be put into a hive filled with healthy combs, or foundation. The portions of comb containing the diseased brood should be carefully cut out and buried, and the remainder converted into wax. If honey remains, it can be utilized for feeding, by thoroughly boiling and skimming it. A quart of water may be added to 10 lbs. of honey. The utmost vigilance must be constantly maintained to prevent any bees of other colonies from having access to the honey, combs, or hive of the diseased stock. The condemned hive may be cleansed completely by scalding it with boiling water and scraping thoroughly. Exposure to the weather will usually complete the disinfection.

DUE TO A FUNGOID GROWTH.

The researches of modern German investigators have shed much light upon the nature of this malady, and the view that it is a fungoid growth, propagated by means of the spores, or seed-vessels, is being adopted by many of our best bee-keepers. The same spirit of intel-

ligent inquiry to which we owe so many of our striking improvements, has provided a remedy with which I have no experience, but which I accept from good authority.

REMEDY.

The remedy is Salicylic Acid, dissolved in alcohol, or in a solution of Borax in water. Mr. Muth's recipe, as I quote from "Cook's Manual," is, one hundred and twenty-eight grains of Salicylic Acid, the same of Soda Borax, and sixteen ounces of Distilled Water. This fluid is thrown in a fine spray over the combs, the brood being previously uncapped. This is said to be harmless to the bees but fatal to the fungi. The same precautions are necessary as to the care of the honey, and the confinement of the bees, as above stated.

PARASITES.

The statements of Prof. Packard, and other naturalists, combined with my own observations, have led me to favor the view that the original cause of this disease is a parasite feeding upon the larvæ, producing death and putrefaction. The small holes in the caps of the infected cells possess a significance in this connection. The remarkable diminution of this scourge within the past few years, is to be accounted for, I think, upon a similar theory. It is consistent to suppose that among the many various parasites that infest the bee-hive, there are those which prey upon the destroyer of the larvæ, and thus destroy them in turn. Corroborative evidence of this, is found in our experience with cabbage and currant worms, potato bugs and other pests, which, after a few seasons of unchecked devastation, are overtaken by their parasitic enemies, and their ravages materially lessened.

Those who have not given attention to the subject of parasites, can hardly be aware of the number and variety of

these minute pests. I have made them a subject of particular study and observation, with increasing interest. In the course of my investigations at various periods during the past three years, I have examined hives in some of the leading apiaries of this State, and in every instance have found several varieties of parasites present, in greater or less numbers. I have thus far discovered nine distinct forms, but whether they are distinct species, I am unable from lack of entomological knowledge to determine.

The conditions under which I have generally found them to be most troublesome, and annoying to the bees, indicate to my mind, that much of the difficulty encountered in wintering bees, may be due to their presence.

It has long been claimed by our best writers on the subject of wintering, that one of the prime requisites for success was perfect quiet. It has also been noticed by many that while some swarms remained very quiet, others could be heard buzzing, and would be constantly uneasy. The fact that some were quiet, shows that the uneasiness was not due to any external disturbance. It has often been a subject of much perplexity to me why these different conditions should exist.

Some writers have advised setting such restless swarms upon their summer stands for a purifying flight, and this may be desirable, inasmuch as they have necessarily been stimulated to a large consumption of food by this undue excitement; but the original cause of this disturbance has not yet been understood.

I have found such swarms clearing the dust from the bottom boards, and upon examining it as they had thrown it from the entrance, I discovered these parasites in large numbers which had been ejected from the hive. I find the Italians much more liable to be disturbed by them than the natives. Their tendency to defend themselves is here manifest, and they are more

easily aroused to action. This may account for the cases that are cited where the natives winter better than the Italians. Another proof that the worrying of swarms while in winter quarters is occasioned by these pests, is the fact that the bees gradually leave the hive and fall upon the cellar bottom ; and when set upon their summer stands, these weak swarms will be found throwing these parasites from the hive in large numbers. It has been demonstrated by the experience of many, in wintering, that when the ventilating slide in the bottom board is left open, the bees in most cases cluster lower and directly over the opening, and are found to keep more quiet. This method has been recommended because of the evidently better results. I had supposed that the advantage lay in the fact that they were more certain of their freedom from the opening being so near, and I yet believe this to be a condition which favors this result. It occurs to me, however, since my acquaintance with these parasites that they were also more easily removed from the hive when it was thus arranged. I have examined the dust which dropped from the cluster through this opening, when in winter quarters, and lodged upon the top of the hive beneath, and in nearly every case found these insects. It has been found to conduce to successful wintering to place a rim under each hive, raising it a short distance from the bottom board. In this case, the insects in the dust would be farther from the cluster of bees, and less likely to annoy them. It has often been noticed that during the spring and summer months, young bees are thrown from the cells that have been, through some cause, destroyed before maturing. Cases have been reported where young bees have been so removed in large numbers. It seems very reasonable to infer that these may have been destroyed by parasites, as I have found them in the bodies of such bees.

They are found in all parts of the hives where the bees

can not reach them. Where the mat hugs closely to the frame, they will often be found between it and the frame. Some of them frequent the hive apparently for honey

Fig. 85.
"HONEY BUG."

Fig. 86.
TRICHODES APIARIUS.

alone; others seem to be found only in the dust under the cluster, while yet others appear to feed upon the bees, especially the young and immature bees that are thrown from the combs. The insect found most frequently in the dust is a small chestnut-brown beetle, about one-twelfth of an inch in length, and clothed, as seen under the microscope, with the most minute hairs. This beetle is given at fig. 85, of course greatly enlarged.

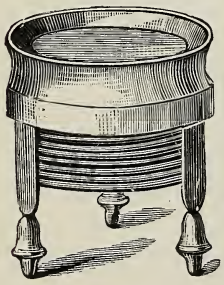


Fig. 87.—SEED GLASS.

As this is supposed to feed upon honey, it is known to bee-keepers as the "Honey-bug." A beetle, which in Europe destroys the larvæ of the bee, is *Trichodes apiarius;* I have occasionally detected what appears to be this insect, as it agrees well with Packard's figure, which is here given in fig. 86. Some evidently harbor in the minute pores of the wood, as often, when I have brought a bottom-board into a warm room for examination, scores would shortly appear where

scarcely one could at first be discerned. The good results claimed to follow a thorough painting of the hive, within as well as without, may arise from the closing of its pores by the paint, and the consequent exclusion of these insects. Under certain circumstances, however, this gain may be counterbalanced by disadvantages otherwise mentioned. A common seed-glass, such as are sold by opticians (fig. 87), for detecting adulterations or impurities in seeds will answer. Better still, as affording a higher power, and being more convenient in use, for observing these parasites, is the *American Agriculturist* Simple Microscope (fig. 88), offered by the Orange Judd Company.

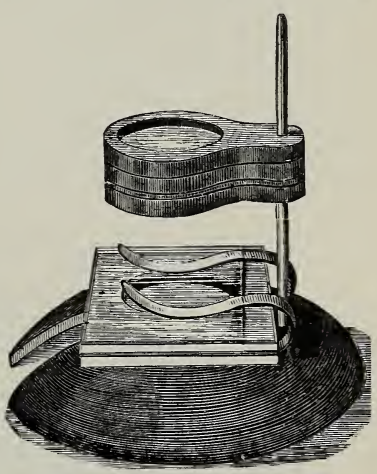


Fig. 88.—SIMPLE MICROSCOPE.

The progressive bee-keeper will here find interesting ground for investigation, which has a more direct bearing upon vital points in his pursuit than may at first be supposed. I anticipate that the discoveries of the near future in this direction will not only be surprising, but enlighten us materially in regard to many mysteries for which we are as yet unable to furnish a solution.

BEE-MOTH.

If we combine into one phalanx all other enemies of the bee, and compare their ability for mischief, with that of the bee-moth, we shall find their powers of destruction

but feeble in comparison. From the moth herself we would have nothing to fear, were it not for her progeny, a hundred, or a thousand, vile worms, the food of which is principally wax.

As the instinct of the flesh-fly directs her to a putrid carcass to deposit her eggs, that her offspring may have their proper food, so the bee-moth seeks the hive containing combs, where the natural food of her progeny is at hand. During the day, a rusty brown miller, with its wings close

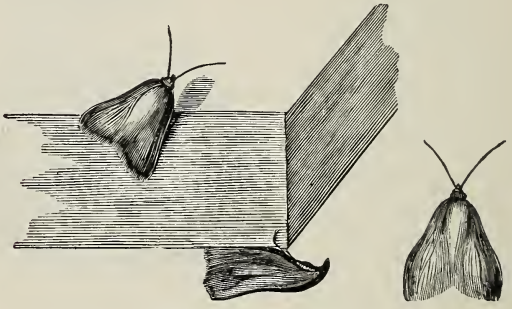


Fig. 89.—BEE MOTH.

to the body, may be often seen lying perfectly motionless on the corner of a hive, or on the under edge of the top, where it projects over. They are more frequent at the corners than anywhere else, one-third of their length projecting beyond it, appearing much like a sliver on the edge of a board that is somewhat weather-beaten, (fig. 89). Their color so closely resembles that of old wood, that no doubt their enemies are often deceived, and they thus escape with their lives. As soon as darkness shuts out the view, and there is no danger of their movements being discovered, they throw off their inactivity, and commence searching for a place to deposit their eggs, and woe to the stock that has not bees sufficient to drive them from the comb. Although their larvæ generally has a skin that

the bee cannot pierce with its sting, it is not so with the moth, and of this fact they seem to be aware, for whenever a bee approaches they dart away with a speed much greater than that of any bee disposed to follow. They enter the hive, and dodge out in a moment, either from fear of the bees, or from having actually encountered them. Now it needs no argument to show that, when our stocks are well protected, there must be a poor chance for the moth to deposit her eggs upon the combs, which instinct teaches her is the proper place. But she must leave them somewhere.

WHERE THEIR EGGS ARE DEPOSITED.

When driven from all the combs within, the next best places are the cracks and flaws about the hive, that are

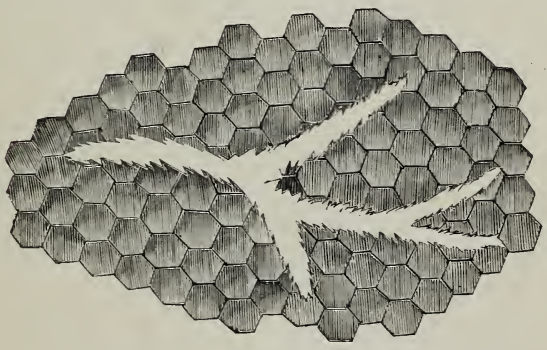


Fig. 90.—WORM GALLERY IN COMB.

lined with propolis, and the dust and chips that fall on the floor-board of a young swarm not full. This last material is partly wax, and answers very well instead of comb. The eggs will hatch here, and the worms sometimes ascend to the comb; but if the dust that collects upon the bottom is kept brushed off clean, it will prevent those hatched there from going up, and also hinder the bees from

taking up any eggs on their feet, if this should happen to be the method by which they get among the combs of a populous stock. They are often detected there, and I can conceive of no other means by which they can be deposited. A worm lodged in the comb makes his way either to the center, or between the heads of the young bees in the cells and the sealing, and as he proceeds, eats a passage, lining it with a shroud of silk, and gradually enlarging it, as he increases in size, as shown in fig. 90. When combs are filled with honey, they work on the surface, eating only the sealing. In very weak families, this silken passage (fig. 91) is left untouched, but is usually removed by all strong colonies.

Fig. 91.—WORM GALLERY REMOVED.

When a worm is in the center of a comb filled with brood, its passage is not at first discovered. The bees, to get it out, must bite away half the thickness of the comb, removing the brood in one or two rows of cells, sometimes for several inches. This will account for the number of immature bees often found in the spring on the floor-board at morning ; as well as in stocks but partially protected after the swarming season.

DEVELOPMENT OF THE LARVÆ.

When undisturbed, the larvæ will grow one-half or two-thirds larger than when their right to the comb is disputed. In one case they often make their growth, and actually wind up in their cocoon, when less than an inch in length ; in the other, they will quietly fatten until they are an inch and a half long, and as large as a pipe-stem (fig. 92.) When first hatched

Fig. 92.—MOTH LARVÆ.

from the egg it is difficult to discern them with the naked eye. Their rapidity of growth depends as much on the temperature in which they are placed, as upon their good living. A few days of hot weather may develop the full-grown worm, which would require weeks and even months in a lower temperature.

The larva, after spinning its cocoon (fig. 93), soon changes into a chrysalis, and remains inactive for several days, when it makes an opening in one end, and crawls out. The time necessary for this transformation is also governed by the temperature, although I think but few ever pass the winter in this state. A moth will rarely be found before the end of May, and not many are seen until the middle of June; but after this time they are more numerous until the end of the season.

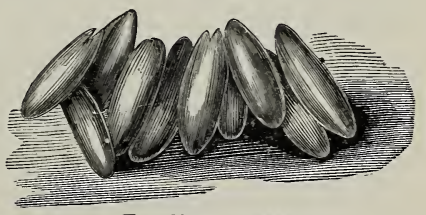


Fig. 93.—COCOONS.

DESTROYED BY SEVERE COLD.

Mr. Quinby's experience, as well as my own, leads me to differ with some modern writers on this point, and I am compelled to maintain, that if combs containing eggs or larvæ are exposed to the severe cold of our northern winters, not a single worm will be produced before the middle of June, or until some moth, matured in another hive, has had access to the combs, and an opportunity to deposit her eggs therein.

REMEDIES.

It has already been observed that the Italians are much less liable to be disturbed, or injured by the bee-moth,

than the natives. Their disposition to defend themselves so vigorously, is an invaluable ally to the careful bee-keeper. With the frequent handling of movable combs, in the various operations incident to the season, a worm in any part of the hive can readily be detected and disposed of, and there is little excuse for allowing them to become numerous. A knife or other sharp-pointed instrument should be at hand to administer speedy justice, as every one not destroyed, soon becomes a host. Combs taken from hives in which bees have been wintered, and later in the season, such spare combs as the moth may have had access to, should be examined, and if signs of its work are seen, the combs should be placed in a box, and subjected to the fumes of brimstone. Such combs are valuable, and should be preserved. If, from any mishap or carelessness, a stock becomes so over-run with worms as to be in danger of destruction, the bees should be removed, and the hive and contents thoroughly fumigated with brimstone. If any brood should be worth saving, let it be cut out, and cared for. The combs unfit for any purpose, should be buried or burned.

MOTH-PROOF HIVES.

No hive has ever yet been invented which will exclude the moth. It is distressing to contemplate the amount of humbuggery that credulous bee-keepers have endured for scores of years, in the shape of so-called moth-proof hives. Let it be distinctly understood by all beginners that the moth is not the cause of the decline of a once healthy stock. It simply takes advantage of the weakness induced by other causes. Therefore, the obvious remedy or preventive is, to "keep all colonies strong," and destroy every moth, larva, or chrysalis at sight.

THE BEE-KILLER.

In the Western and Southern States bees suffer greatly from a two-winged, very voracious insect known as the "Bee-killer." It is the *Asilus Missouriensis* of Riley, and is given in fig. 94, of the natural size, from Riley's "First Report on the Insects of Missouri." Its general color is yellowish brown or yellowish grey, and but little is known of its history and habits. It pounces upon the bee while on the wing, and takes its victim to some plant, or even to the ground where, with its stout proboscis, it sucks out the inside of the bee and leaves but an empty shell. Though occasionally found in the Eastern States, this insect has fortunately not become common. But little is known as to the best methods of destroying it; bee-keepers should be on the watch for this enemy, and destroy it wherever it is found.

Fig. 94.—BEE KILLER.

RATS AND MICE.

Rats and mice are never troublesome, except in cold weather. The entrances of all hives standing out, are much too small to admit a rat. No damage need be apprehended from them except when the hives are in the house. They appear to be fond of honey, and when it is accessible, will eat several pounds in a short time.

Mice will often enter the hive on the out-door stand, when not excluded, and make extensive depredations. Sometimes, after cutting a space in the combs, they will make their nests there. The animal heat created by the

bees, will make a snug, warm place for winter quarters. The "deer mouse" seems to be particularly fond of the bees, while those belonging to the house, seem to relish the honey.

The entrance to the hives should be contracted so that a mouse cannot enter. The apartment in which the bees are wintered, should be cleared of rats and mice, and every means taken to keep them out, as their running over the hives, even if prevented from entering them, annoys and disturbs the bees.

BIRDS.

Most birds are included in the list of enemies of bees, but I have a word to say in favor of some of them. The King-bird is generally placed at the head of the list of feathered depredators. After close observation of the habits of this bird, I am convinced that he destroys not only drones, but workers and queens as well. The King-birds are most active about the apiary at those times of the day when the drones are flying most freely. This indicates to me the greatest injury they may inflict upon our interests. The queens are then usually upon the wing to meet the drones, and are consequently in danger of being caught by the birds. My friend, Mr. E. D. Clark, is quite positive that he lost several queens in one season, in this manner. If I were rearing queens largely, and these birds were numerous at this period, I should feel justified in reducing their numbers, but under ordinary circumstances, I should be slow to recommend their destruction.

Since writing the above, Captain Hetherington has related to me the conclusions of another gentleman, who is a close observer. The general result of an examination of their crops is, that the remains of the bees are in such a mutilated condition as to be beyond identification. This

gentleman noticed a King-bird catching several bees near the same spot, and upon close scrutiny saw small particles drop to the ground as the bird captured the bee. Upon a careful search, he found both extremities of the bees upon the ground, and came to the conclusion that the bird caught the bee in such a manner as to secure the honey-sac, and drop the remainder. While my own experience has not verified this, it does not disprove it. Wrens are of great value in an apiary in picking up every worm that may chance to be exposed. Every inducement should be presented to attract them to the vicinity of the hives. Suitable houses in which they may build their nests should be put up in appropriate places. Cat-birds are also worthy of passing notice. They may be seen at nearly all hours of the day, passing from hive to hive, picking up worms and immature bees as they are thrown out.

ANTS, TOADS, AND SPIDERS.

Ants are undoubtedly an annoyance to the bees as well as to their keeper. Their fondness for sweets is such that the bees must guard their stores well, to protect them from these tiny marauders. They may usually be driven from the hives where they congregate, by brushing and smoking. Alcohol, applied to the parts they frequent, will speedily destroy them. That toads feed upon bees may easily be ascertained by any watchful bee-keeper; yet, as they are seldom, if ever, found catching them at hours when the life of a queen would be endangered, they are less obnoxious than King-birds. The only harm that can ever be done by spiders is that the bees will sometimes become entangled in their webs when spun about the hive. With little care both the spiders and their webs may be destroyed.

CHAPTER XVI.

MARKETING HONEY.

A SUBJECT OF IMPORTANCE.

We have now reached a subject of considerable importance, but which has not excited any unusual interest until very recently. This is the more remarkable from the fact that the appearance and condition of honey, when put in market, has a direct effect upon the price received. It is to be observed that not only do different markets vary in the form of package required, but the demand changes from year to year. Where ten years ago large boxes, in as large cases as could conveniently be handled, were universally sold, there has been a steady change to smaller boxes and lighter cases. These facts make it indispensable for an enterprising bee-keeper to study his market carefully, and prepare his honey accordingly. In connection with the demands of a more distant and general market, we should not ignore the advantage of a large and well supplied home trade. In addition to this, experience proves that where the crop is not large enough to justify shipping to a distance, it pays well to put a wagon on the road, and deliver to consumers at their doors, thus saving commissions and the risks of transportation.

NEATNESS.

It is beyond question that, aside from the best size of boxes and packages, the utmost neatness and precision in manufacture and preparation must be observed, to give any certain brand of honey a permanent reputation among the large dealers. To producers, who have invested time and capital in this business to much extent, these considerations are important. A standard of quality, so well

established, that the name of the producer alone, is a guarantee of excellence, is an achievement worthy of earnest effort.

OBJECTION TO LARGE CASES.

The disadvantages of too large cases for shipping box-honey are frequently evident. I have often seen combs broken from the boxes because the package was too heavy to admit of its being handled with sufficient care. Customers will often refuse to purchase large cases, even when the honey suits them better than that in cases one-fourth the size, and, instead of a large case, will take four of the smaller ones to get the desired amount.

TWO-STORY CASES.

Mr. Heddon recommends cases in which two tiers of boxes are to be placed. There are objections to this form of case. If, from any cause, a comb in the upper tier is broken, and leaks ever so little, the boxes below will inevitably become soiled. This is a sufficient argument in favor of but one tier of boxes in a case.

SMALL CASES POPULAR.

The size of case which is coming into general use with the best apiarians, is one that contains twelve single-comb boxes, or six two-comb boxes. They will hold about twenty pounds, the weight varying with the size of the box. This case, now known as the "Prize Crate," has been the favorite package in this section for several years. In 1877, I packed a portion of my honey in still smaller cases, each containing but six boxes weighing about ten pounds. I had hardly packed the first one, before a party seeing it said it was just the package he wanted for family use. Similar expressions of approval, both before and after they were placed in market, satisfied me that such a

size would meet the wants of a large class of customers, both dealers and consumers. Still later experience convinces me that even a smaller case yet, will become popular. I have put up cases of three boxes only, weighing but five pounds, for the New York market, which were much liked, and sold well. Figure 95 shows three sizes of cases, holding five, ten, and twenty pounds respectively. The objections that arise are, the trouble of handling such small packages, and extra cost of manufacture.

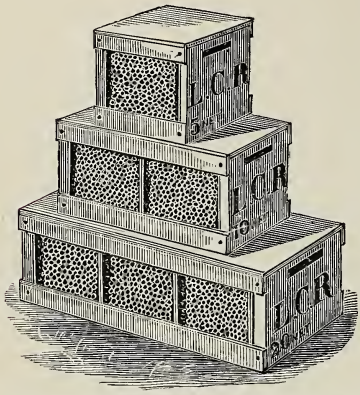


Fig. 95.—THREE SIZES OF HONEY BOXES.

The latter is amply met by the increased popularity of the case. To obviate the extra trouble of handling, I made the small cases very light, and re-cased them in larger ones, each holding eight, making an average net weight of forty pounds. The added labor and expense is partially met by the decided advantage of placing our honey in a distant market, in a neat and attractive condition, the outer case preventing the inner ones from becoming soiled. Those who have most experience in shipping honey will see in this an advantage worthy of

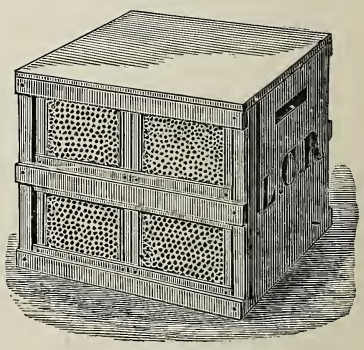


Fig. 96.
EIGHT FIVE-POUND CANS RE-CASED.

some extra trouble. Figure 96 represents a case of this kind.

PREPARING BOXES FOR MARKET.

All boxes should be thoroughly cleaned of any propolis and wax that may adhere to them. The section-boxes must now have the glass added. The disadvantages of putting section frames, or unglazed boxes, in market have been enlarged upon in another chapter. There may be markets that demand such, but in all with which I am familiar, it is desirable to have glass on both sides. I do not urge the glazing of each section-box from pecuniary motives, but from the evident fact that it is more practical and agreeable to customers. The popularity of the single-comb box should be proof of the need of ample protection with glass. It would not be very objectionable, with five or ten pound cases, to put glass upon but one side of each outside box. The case is sold as a family package, and the first box used may be taken from the center, and the outside one moved up, thus keeping it tolerably close. I should prefer, however, if boxes in these smaller cases were not to be wholly glazed, to not put any in, but glaze the sides of the case instead, thus keeping the combs entirely free from dust and intruders. The same suggestions would be applicable to section frames. If box-honey has been properly cared for when removed from the hive, it may now be prepared for market without danger of injury from moth-worms after being cased. One of our Bee Journals recently advised putting honey upon the market as soon as it was taken from the hives. This would be dangerous counsel to follow, as it would be certain damage to future sales unless disposed of and consumed at once. Two-comb boxes should have all entrances closed. For this purpose, use a heavy quality of paper, cut the proper size, and pasted over the openings with common flour paste.

GRADING HONEY.

In casing honey, it should be graded closely, and each quality packed separately. Where white honey only is secured, it is possible that there may be but one quality; yet it is usually best to make two grades, even if it is simply marked, 1st and 2d. Where both white and dark honey are gathered, it is usually necessary to make three grades. I mark best quality, "C," buckwheat, "B," and boxes containing a portion of each, "M," or mixed.

PACKING HONEY.

Each case should be weighed before being filled, and its weight marked upon it. The honey should also be weighed before putting it in the case. Select the desired number of boxes, and if they do not weigh even pounds, change a box or two for a lighter or heavier one, until the right weight is obtained; then fill the case and mark the net weight upon the end. Let the combs stand lengthwise of the case. In handling section boxes, from the time they are first made, until ready for market, it is well never to set them down upon the sides that are to show when cased. When packing comb-honey to ship to a distance, it should be placed in the cases, with the side downwards to which the honey is most firmly secured.

MARKING CASES.

In shipping honey to large buyers, or to commission merchants, they will usually furnish a stencil plate for marking the address. This should be upon one end of the case, and the shipper's initials upon the other. The letters indicating the quality, weight, etc., should be placed as shown in fig. 95. The neatness and business like accuracy with which these details are carried out, will add much to the reputation of any producer, as well as enhance his profits. It is wise, never to put your

whole name and address upon your cases, unless you sell directly to the retail dealers, as it will usually be erased by the wholesale merchants, giving the case an untidy and damaged appearance.

RELIABLE DEALERS.

The necessity of patronizing a strictly reliable house cannot be too strongly impressed. It is never judicious to allow a popular brand of honey to go into the hands of dealers who are known to handle adulterated honey in any form, or are in any way untrustworthy. I have refrained from selling my honey to such parties, even when offered a larger cash price for it, than I could realize by placing it in the hands of a reliable commission merchant. Thoroughly honest and trustworthy men can be found in every city and town, and should be sought out and patronized.

MATERIAL FOR CASES.

For the ends of the case and the slats at the side I find nothing better than basswood. The very best white basswood should be procured for the purpose. The top and bottom may be of pine, or basswood may be used for the whole case.

MANUFACTURING CASES.

All work should be done in the neatest and most workmanlike manner. The thickness of the ends should, of course, vary according to the size of the cases; from $^1/_2$ inch for 5 lb. cases, to $^7/_8$ inch for a 20 lb. case. In shipping and storing in commission houses, where room is limited, it is often necessary to pile the cases several tiers high. It will be seen that they must be strong that those at the bottom may sustain the weight of all above them. While in New York in the fall of 1878, I saw a fine lot of honey leaking badly, caused by

the lower tier of cases being racked during transportation. Therefore, let all cases be not only neatly, but substantially made. At the proper place in each end, as shown in figs. 95 and 96, a handle should be made by the use of a wabble saw. A top and bottom, and four strips $1^1/_4$ inch wide and $^1/_4$ or $^1/_2$ inch thickness, according to the size of the case, constitute the remaining material. This makes a neat, convenient, and attractive case.

TRANSPORTATION.

When circumstances will permit, I prefer shipping honey by boat, yet I have transported it largely and safely in an ordinary railroad freight car. This manner of shipping is very commonly practised, large quantities coming in this way from California to New York in good condition. Care must be exercised to pack it properly in the car. Select as clean a car as possible, and place upon the bottom about two inches of dry sawdust, or straw. Place some straw, or bags of sawdust, against the ends of the car, and crowd the first tier of cases firmly against it, with the ends of the cases to the end of the car, as in this position the combs are less liable to be broken by sudden stops and starts. Avoid putting too many in a pile, so as not to strain the lower cases. Pack the tiers firmly together, and leave no chance for displacement. If the car is not full, and packing is not put in at both ends, pieces of board should be nailed across the car, about 6 inches from the last tier of cases, and the space between the boards and the cases packed with straw or bags of sawdust, the same as at the end. Small quantities may be shipped safely by express.

PREPARING EXTRACTED HONEY FOR MARKET.

I am confident that the market for extracted honey will gradually improve as customers become convinced

that granulation is a sure test of purity ; and honey in this candied form will soon take the lead, if the nefarious business of adulteration with glucose continues. It should be remembered that honey containing glucose will not become candied, and that, as a rule, all pure liquid honey will granulate in cold climates. If pure honey is placed in a good fruit jar, and heated to 160° and sealed in the same manner as fruit is canned, it will remain liquid. Customers preferring it in a liquid state, should purchase the granulated honey, and liquefy it for themselves. Producers wishing to ship it in this form, should patronize some thoroughly honest dealer, or seal their packages, so that they cannot be tampered with.

PROCESS OF LIQUEFACTION.

The process of liquefying candied honey is very simple, yet caution must be observed not to scorch it. The vessel containing the honey should be placed in a suitable boiler, or vat, filled with water, which should be gradually raised to a temperature of 160°. If the quantity of honey is large, it should be stirred as it melts. The vessel should be raised by blocks of wood, so that the water can pass freely under it. In my early experience in this process, I found it possible to scorch it badly, even when heated in water ; and great care must be exercised that it does not heat up too rapidly.

KIND OF PACKAGE.

The package in which extracted honey will sell best must be decided by the demand. In our home market, it is sold largely in jelly cups and glass fruit cans ; also in 20 to 40 lb. pails, it being cut from the pail, and sold the same as butter. In cold weather I have known parties to buy a small pail or tub of honey, which was candied hard, remove the hoops and staves, and cut off the solid honey

in portions as desired. This is more practicable than would at first seem. In putting honey in jelly cups or fruit cans, always furnish a standard article. We once purchased a large quantity of second-class cans for this purpose, because they were cheaper, and when brought into competition with a popular style, the difference was plainly perceptible. When cans are used, let each display an attractive label, indicating the quality of the honey, and your address. Twelve quart cans in a case, similar to those used for box honey, make a convenient package for handling, (fig. 97). At present there is good sale for honey in casks, or firkins, holding from 150 to 200 lbs. Such casks should be well made and bound with wooden hoops, which should be nailed in place, and the casks well coated inside with beeswax, before filling. To coat the casks, allow them to stand in the sun, until they are quite warm. Apply the melted wax while hot; pour a quart of it into a cask, and cork tightly; roll and turn it rapidly until every spot is covered, when the surplus wax may be poured out. The warmer the cask, the hotter the wax, and the more expeditious the work, the less wax will be required. Avoid filling the casks too full with cold honey, for, if allowed to stand in a warm place, the honey will expand, and cause the cask to leak. Very much attention is being given of late to putting up extracted honey in small packages. Even as small as one-quarter pound are becoming popular.

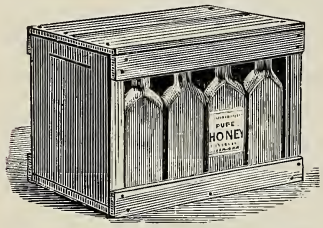


Fig. 97.—TWELVE CANS EXTRACTED HONEY IN CASES.

C. F. Muth furnishes glass bottles (see fig. 98), holdfrom one-quarter pound to two pounds, which are very

desirable, because of their neatness, and also because they will not corrode.

Dadant & Son, Jones and other bee-keepers, use small tin pails, which, when neatly labelled, present an at-

Fig. 98.—MUTH'S HONEY BOTTLES.

tractive appearance, and there is no danger of breakage as with glass. We have used these largely with great satisfaction in our home trade. I would encourage in all possible ways the developing of a home market.

CHAPTER XVII.

WINTERING.

How to winter bees successfully, has been to bee-keepers their most vexatious problem, and it may be safely asserted that failure in bee-keeping is chiefly attributable to defective wintering. We cannot expect profitable returns during the summer unless we commence the season with thrifty colonies, and to insure this condition, they must be properly wintered. While there is yet much to be done before we have a perfect method of wintering, I hope that a varied and extensive experience may enable me to assist somewhat in reaching this end.

PREPARING BEES FOR WINTER.

The properly fitting of the colonies for winter, should be borne in mind during the entire working season. In estimating the quantity of honey required for wintering, it must be remembered, that a swarm should be confined to a limited number of combs. Many colonies are lost through lack of attention to this point. A marked advantage is found here in the use of the closed-end standing-frame; this, of itself, regulates the size of the brood-nest, which varies in proportion to the number of frames used.

The necessary supply of honey should be contained in five, or, at most, six combs of the Quinby size. Five combs, averaging five pounds each, or six, with four pounds each, will generally prove sufficient. For wintering out-of-doors, an excess of five pounds should be allowed, and as much less will answer for hives wintered under cover. The outside combs will naturally contain more than those at the center, leaving the latter with

more empty cells in the proper place for occupancy by the bees. If they are to be left out-of-doors, care must be taken not to have these center combs too full of honey, as the bees must cluster more compactly than when they have warmer surroundings. Mr. Betsinger advocates wintering in combs full of sealed honey. This is an extreme which I cannot endorse, but the opposite extreme of too much empty comb, should also be avoided. In determining the amount of winter food, it is necessary to know the average weight of the hive and contents, independent of the honey; all stocks should be weighed, and those too heavy, should exchange combs with such as are lacking. If, from any cause, there is a deficiency, it must be supplied as directed in the Chapter on Feeding.

The habit of the bees, of filling out with honey, cells containing pollen, is sometimes the cause of an incorrect estimate of the amount of honey in a hive, especially if it has been queenless, and the pollen unconsumed by young bees. I have furnished such combs to colonies for winter, judging from the weight that the supply would be ample and found, too late, that the excess of pollen had deceived me, as the bees perished before spring for want of honey. At the same time that we are considering these conditions, we must aim to secure large quantities of young bees for winter. The importance of this consideration, cannot be over-estimated.

In the winter of 1869–70, probably more bees were lost than in any other season in the history of bee-keeping. Those who suffered as largely as we did at that time, will remember that the preceding season of 1869 was so poor, that, during the latter part of it, very little, if any brood was reared. The result was, that nearly all of the bees that went into winter-quarters were old. During the spring of 1870, these old bees wasted very rapidly, as might have been expected, and very few swarms recovered sufficiently to store surplus honey to any extent, although

the season was one of the very best, as is usually the case after the other extreme.

In the State of Vermont 1869 was a very favorable season. In 1870, we purchased thirty colonies there, and moved them to our own apiary at St. Johnsville, N. Y. Ten of these we used for the trade, and devoted the remainder to surplus, of which they gave us more than the 170 swarms which we had wintered. I mention this merely to illustrate the contrast in results from bees that winter well, and those that are weak and feeble in spring.

In all manipulations at this season, great care should be observed not to injure the queen, as it is essential to success that each colony begin the winter with a perfect, prolific queen. Holes should be made with a knife through each comb for the bees to pass through, from one to another, without being obliged to go around the outside. This is especially necessary if they are to be wintered out-of-doors. Thimbles of tin, about $^1/_2$ inch in diameter, placed in the comb, are useful for this purpose.

Where the Quinby hive with the large case is used, the frames may be prepared for wintering in-doors, by placing them upon a small bottom-board, with a quilt or mat covering the entire top, and the panels at the sides, as in fig. 99. These may be arranged early in the fall, and left standing in the outside case, until it is time to put them in. The outside case is left on the summer stand. The quilts may be made of unbleached muslin, and should con-

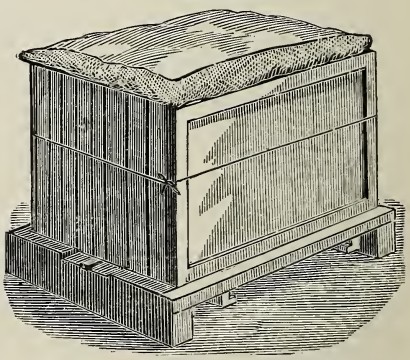


Fig. 99.—FRAMES PREPARED FOR WINTER.

tain about one half a roll of cotton batting. They should be tied at intervals of three or four inches, and sewed together at the edges. These quilts are also available for all frame hives. All hives and stands should be numbered, so that when set out in spring, each colony will occupy its own location. While this is not absolutely essential, when they are not to be taken out until spring, it is in many respects desirable.

PERFECT QUIET ESSENTIAL.

The great necessity for leaving bees undisturbed, as far as possible, during the entire time that they cannot gather honey or pollen, is not fully appreciated. As good results as have ever been reported, have been attained where bees were wintered by burying; yet, it is quite evident that, aside from the one item of perfect quiet, much better conditions may be secured than when surrounded with damp soil. If it were not that an occasional examination is needful, to see that rats or mice have not affected an entrance, or, to ascertain if the room is not unduly damp, I would advise locking the door of the wintering apartment, and not opening it again until spring. But I advise making these examinations and any needed changes as quietly and seldom as possible. All ventilators should be so arranged as to be regulated from the outside, and means for ascertaining the temperature, without entering the room for the purpose, should be provided, as hereafter described.

OUT-OF-DOOR WINTERING.

Many practical bee-keepers still advocate out-of-door wintering, and in many instances, there is no question but bees may be wintered upon their summer stands with success. Unless they may be placed in a suitable apartment, where the necessary conditions can be maintained,

I am satisfied that it would be better to prepare the hives as will be described, and leave them upon their summer stands. Yet, my experience in wintering under nearly all circumstances, will, I think, warrant the assumption that, all things considered, in-door wintering is preferable, particularly in our cold climate.

If bees are to be left upon their summer stands, the first thing necessary is, to provide the hives with ample protection from cutting winds. If this is not afforded naturally, a tight board fence should be built for the purpose. Many practice packing straw about the hives in such a manner that the sun cannot, at any time, shine upon any part of them, unless temporarily upon the front, which is the very thing that should be avoided, as this induces the bees to fly. Properly arranged packing at the tops and sides of frames, is often very advantageous, yet, as it is generally used, I think it is the cause of the loss of more bees than it benefits. I speak from experimental knowledge, having packed hundreds of colonies in the Quinby hives. It will be seen by noticing the construction of this hive, that the case is large and that, when all boxes are removed, the space for packing is abundant. I have filled this space with saw-dust, chaff, cut and whole straw, and dearly bought experience forces me to say, that with improper management, very bad results come from the use of such packing. The argument offered in its favor, is, that the packing will absorb the moisture, and retain the warmth of the bees. This is true, and it is equally true that, unless the sun is allowed to reach this packing and evaporate the moisture, it is the direct cause of harm.

If bees are to receive no attention, I would prefer to risk a common box-hive with holes in the top, loosely filled with rags or some porous substance, than those packed with chaff or straw. Cold is not so frequent a cause of loss in winter as many suppose, provided the

bees have plenty of proper food, and are kept suitably dry.* But, if proper care is taken to occasionally remove the roof, and often the cap or cover of the hive, and allow the inside to receive the direct rays of the sun to dry off all moisture, success in wintering will be much more certain. If the case or cap be adjusted loosely, it will afford the moisture better opportunity to escape. Care must, of course, be exercised in taking these precautions not to jar, or in any way arouse the bees to activity; nor should the hive be disturbed at any time when the temperature would induce the bees to fly. At such times, I would prevent their flying, by shading the hive from the sun.

IN-DOOR WINTERING.

Dry, pure air, and a proper and even temperature, are two prime essentials in successful wintering. These certainly can not be so perfectly controlled out-of-doors as in a suitable in-door repository.

ARTIFICIAL HEAT.

The necessity of being able to supply artificial heat to aid in securing proper ventilation, temperature, and freedom from moisture is very generally conceded. I have had excellent opportunities, while purchasing bees in various sections, for noticing the circumstances under which they had been wintered, as well as the effect upon their condition in spring, and found that in proportion as they were aided by artificial heat, they had wintered well, other conditions being equal. Very often, when a cellar was dry, and a constant fire was kept above, the most satisfactory results were attained. Mr. J. H. Bucklin, of Little Falls, N. Y., wintered bees in a room, partitioned off in a cellar, with a brick wall between it and

* I have found buckwheat chaff to be preferable to other materials for packing.

a furnace, during the most disastrous seasons, when nearly all the bees near him perished ; he had admirable success.

DRYNESS.

I can not place too much stress upon the necessity of dry air and surroundings where bees are to be wintered. It is generally conceded that Mr. Quinby was the first to advocate the importance of keeping bees uniformly warm. Could he, instead of myself, have been able to revise this work, he would have urged the imperative need of a dry atmosphere as well as a uniform temperature. After his discovery that the bee, when in a healthy condition, voided its fæces in a dry state, he clearly saw that to aid in carrying off the moisture, a dry atmosphere as well as a sufficient degree of heat was indispensable. Therefore, after experimenting with nearly every method that has been brought to my notice, I have come to practice and advise in-door wintering exclusively, because in no other way can these requisites be so certainly provided. The objection that this involves extra labor and expense is more than met by the diminished consumption of food. Experiments in weighing colonies monthly, both in-doors and out, prove that bees properly provided for in-doors, will consume from one-third to one-half less honey than when exposed to the changeable weather of our northern winters. This saving will more than balance any considerations of extra expense.

Objections to wintering in a cellar often arise from a lack of understanding of some of the requisites. To economize room, the hives are often set as close to the wall as possible, where they absorb moisture, and become mouldy and unhealthy. Again, they are placed upon shelves attached to the supports of the floor above, and are thus subjected to every jar from the room above them, with proportionately bad results.

BEST ARRANGEMENT OF A CELLAR.

The part to be used for the storage of the bees should be directly beneath a room where a fire is regularly kept. The cellar bottom should be well laid with hydraulic cement, and the walls plastered and pointed with the same. This cement prevents moisture from passing into the cellar. A cellar should be most thoroughly dried when thus prepared with cement, before bees are placed in it. I have known very serious results ensue where this precaution was not observed. It is sometimes needful to place a stove in the wintering apartment, connecting it with the stove-pipe above by means of the ventilating pipe, and keep a constant fire for a month, in order to bring it to a fit condition for use.

The room should be closely partitioned off with matched lumber, so that it will not admit the least ray of light. On the sides next to the wall it should be ceiled about one foot from it. If this is not done, that space, at least, should be left unoccupied. The bees would do better in a solid body in the center of the room than close to the walls. Fresh air should be brought into the room through a window or similar opening by means of a tube, or air conductor, made of boards, six or eight inches square. Let it extend to the bottom and across the room, with holes bored at frequent intervals, the entire length, to distribute the air more evenly to all parts of the room, and avoid a current to any one point, as even a sudden rush of air is objectionable. A five-inch pipe should start near the bottom of the cellar, pass up through the floor, and enter the stove pipe above, as near the stove as possible, to afford an escape for cold and impure air. This may be arranged with a T near the floor above, with an aperture to be opened or closed at pleasure for the purpose of drawing off the warm air when desired from the upper part of the cellar. This ventilating pipe

should be provided with a tight-fitting damper in the room above, that may be regulated at will. The benches, or supports upon which the hives are to stand, should be short and rest upon the solid bottom of the cellar, and the hives placed upon them in tiers, so that the tiers will not touch each other, or the sides of the room. In this manner, but few need be disturbed at once in packing away, or what is more important, in taking out in spring. If the bench is long enough to hold several tiers of hives, there will be a disturbance of all when any one is moved. The thermometer (fig. 100) to test the temperature should be dropped through a hole in the floor above, and attached, by means of a cord, to a cork that fills the hole. The temperature should be kept as nearly at 45° as possible. I should prefer that it never drop below 40° nor rise above 50°. If it rises too high, the damper in the pipe above should be opened to permit the warm air to be drawn out, and the tube from the outside also opened, to allow pure cool air to take its place. With a temperature of 45°, it is usually prudent to give both upward and lower ventilation in the hives. If a quilt is used over movable frames, it will be porous enough to afford the desired upward ventilation. In box-hives, the holes in the top should be loosely filled with rags, and the hives raised slightly upon the bottom board to admit air. In this regard, my experience differs with that of Hetherington and Elwood, who use tight caps over their frames in wintering.

Fig. 100.

A SPECIAL BUILDING FOR WINTERING.

Where bee-keeping is made a specialty, and the very best arrangements for wintering are desired, they may without doubt be best secured by building a repository

for the purpose. Many recommend a house built above ground with walls of several thicknesses, well packed, and dead-air spaces between. Mr. R. Bacon, of Verona, N. Y., uses such a house, and pronounces it a success. The best one of the kind that I ever saw was built by Captain Hetherington, and it seemed as well adapted to the purpose as could be wished; yet Mr. Hetherington has discarded it as a failure, and adopted the system of "clamps," which I am about to describe.

CLAMPS.

Those who have read Mr. Langstroth's work on the Honey Bee have doubtless been much interested in an article by the Rev. Mr. Scholtz, translated from the "Bienen Zeitung," by Mr. Wagner, which describes a system of wintering in clamps. This method of Mr. Scholtz's has led to an improved clamp or bee-house, partly underground, which is proving an admirable success. This is really but an improved form of the old method of burying bees. Mr. Hibbard, of Auburn, N. Y., modified the Scholtz clamp by erecting a permanent framework for the sides, but with a temporary roof or covering. In 1873, P. H. Elwood, of Starkville, N. Y., prepared a clamp, over which he arranged a permanent roof, and built a door for convenience in entering the apartment. The bottom and sides were covered with hydraulic cement. Clamps similar to this are now used by many of the leading bee-keepers of New York State, with the best results.

Captain Hetherington, after making some changes, and furnishing facilities for artificial heat and a most thorough system of ventilation, has adopted this system of wintering in his extensive apiaries. He has three very fine double clamps, one of which is represented in figure 101. A clamp of this form is built by first making an ex-

cavation in a dry knoll, or side-hill, to the depth of about three feet. If the number of bees only demand a single clamp, the door may be placed at the end; but if a double clamp with two rooms is needed, the door should be at the center of one side, opening into the ante-room for the stove, between the two apartments. This idea of warming clamps with a stove is original with Captain Hetherington. A wall should be laid in hydraulic cement around the sides of this three-foot excavation, upon which plates should be laid to support the rafters. These

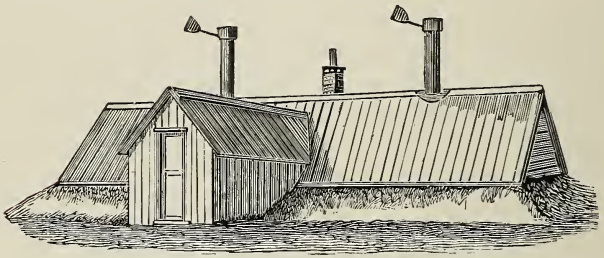


Fig. 101. —DOUBLE CLAMP.

should be sufficiently heavy to sustain the superincumbent weight. The roof should be quite steep. Slats about three inches wide are nailed over the entire surface of the rafters, about one-fourth of an inch apart. Over these straw is spread to keep the earth from falling through before it becomes packed. The ends should be walled or banked to the peak of the roof, and the entire top covered with at least twelve inches of dry earth. A good roof should be put over all to keep it perfectly dry.

In the thick side wall, double doors should be built, containing an air space. Similar doors should be made to the rooms inside. The stove is to be set up in the small ante-room, and fresh air brought to it through tubes, and warmed when needful. Openings from the stove-room to the bee-rooms should be made at the top

and bottom of the partitions. Ventilating pipes must be arranged at the top of each bee-room. As the air is warmed by the stove, and passes to the room occupied by the bees, through the upper openings, a strong current of colder air will be created from the lower part of the room, in the direction of the stove. Capt. Hetherington beds his stove in a brick arch, in such a manner that an opening is left under the stove. This opening connects with the lower opening into the bee-rooms on each side, and also with the bottom of the chimney. The stove-pipe enters the chimney, and passes up inside, nearly to the top. When a fire is made, the air warmed in the chimney by this pipe, increases the draft, and the air warmed under the stove is also drawn up the chimney, and is replaced by the colder air from the bee-rooms. The fresh air brought to the top of the stove from without, will, when warmed, pass through the upper openings, and replace the impure air drawn out at the bottom. The ventilating pipes, as well as the chimney, should be provided with hoods at the top, in order to secure a perfect draft. The perfection of this plan of ventilation will at once be appreciated.

WHEN TO PLACE BEES IN WINTER QUARTERS.

It is frequently advised to leave bees on their summer stands as late as possible, that they may improve the very last opportunity for a flight before being put away for winter. I am fully persuaded that this practice is injudicious, although it doubtless has some advantages. Few who have not been close observers, can realize the number of bees wasted by venturing from the hive during cold, fall weather. Besides avoiding this loss, if we put them in winter quarters early, they go in with the hives dry and free from frost. The most suitable period will vary in different sections. It frequently occurs in our northern latitudes, that they are not put in until the first fall

of snow. This is taken as evidence of the approach of winter, and the bees are at once put away, with the hives damp and in bad condition. Here let me mention an item in favor of the Quinby hive. The frames only being removed to the cellar or bee-room, upon a separate bottom-board, are perfectly dry, even in a stormy time. Therefore I deem it wise to put bees into their winter quarters much earlier than is customary with many apiarians. After a warm, dry day, when all have had an opportunity to fly, is the most suitable time. In our locality the date varies from November the 1st to the 15th, according to the severity of the weather.

FLIGHT DURING WINTER.

Many apiarians have the idea that it is very beneficial to bees to allow them to fly out, at intervals during the winter, many recommending it to be done as often as the weather will permit. Bees may be wintered in such a damp and unsuitable place that this may be absolutely necessary, but it is hardly worth while for me to say to any one who has followed me thus far, that I consider it not only unnecessary, but injurious, when proper provision has been made for their well-being within. If bees are found to leave their hives and fall upon the cellar bottom, they should be brushed up and carried out, as they will give the room a disagreeable odor, and render it unhealthful.

SETTING OUT BEES TOO EARLY IN SPRING.

We are frequently told to remove our bees from winter quarters on the first warm days in spring; even as early as March 1st. I am constrained to say that, as a rule, I consider this a serious mistake. The reason given for so doing is, that the bees are leaving their hives and wasting upon the floor in such numbers, that if not soon set out

and allowed a purifying flight, they will all be lost. One bushel of bees upon a cellar floor, where 100 hives are stored, seems an alarming waste; yet when they are placed upon their summer stands so early as to be exposed to chilly weather and piercing winds, three or four times that quantity may be lost, but being scattered broadcast about the grounds, or to whatever distance they may venture for water or pollen, they are unnoticed, and the loss is not appreciated. This extreme should be carefully avoided. It is a good rule to leave them as long as they will remain quiet. In my own practice I prefer not to set them out until just as the Soft or Red Maple begins to blossom.

HEALTHY EXCREMENT IS ALWAYS DRY.

Every observing bee-keeper has noticed in winter, upon the bottom-board, directly under a healthy swarm, ridges of dust which has fallen from between the combs.

Mr. Quinby made many experiments with this dust, having it carefully analyzed, and became convinced, beyond doubt, that it contained the excrement of the bee, voided in a dry state.

The correctness of this conclusion can be tested, by placing a small quantity of this dust in a little water, and heating it sufficiently to melt the wax, coming from the uncapping of the combs, mingled with it; the residue then will be found to be precisely the same substance as the liquid excrement of the bee, when it has been confined to damp and unwholesome quarters. This discovery Mr. Quinby conceived to have an important bearing upon successful wintering, as heretofore mentioned, and to indicate the necessity of furnishing dry and warm surroundings to promote healthful conditions.

Careful observations, by others, as well as myself, confirm the truth and importance of his conclusion. An

instance which afforded me very satisfactory proof of his correctness, was on an occasion, when I set my bees from the cellar on the 3d and 4th days of May, after they had been housed since November 17th, in a dry and well-ventilated room, and kept exceedingly quiet, during the entire period. When set upon their summer stands, the bees were in so nearly a dormant condition, that they were slowly aroused; the weather being quite warm, the usual voiding of fæces in a liquid state did not take place, and clean, new roofs were not soiled in the least.

CHAPTER XVIII.

HONEY.

The careful Bible reader cannot fail to be impressed with the prominence of honey as an article of food in all early times. Indeed, it seems to have been an element in sacred rites, and to have been held in especial esteem through all the primitive ages. It would appear that in the estimation of moderns, honey and its uses have lost much of their ancient reputation. At the present day, honey is generally considered as merely a luxury, without any special, nutritive, or medicinal value.

USES AS FOOD AND MEDICINE.

There is a growing interest, however, in these particulars, and I anticipate a period not far distant, when its value will be more fully recognized. In his little pamphlet on "Honey as Food and Medicine," Thos. G. Newman gives us much information on this topic.

Honey is not only desirable when combined with our food, but is regarded by many as useful in some forms of

disease. In coughs, or affections of the lungs, honey has long been used, either in its pure state, or when combined with other remedies. It is also efficacious in the treatment of burns. Let the injured part be completely moistened with liquid honey, and immediately covered with plenty of dry flour. This effectually excludes the air, and materially aids in the cure. I consider this a remedy worthy of attention in every household.

ADULTERATION OF SYRUPS.

The use of honey on our tables has largely decreased since the cheap production of sugars. The day has come, however, when the alarming adulteration of sugar and syrups, especially the latter, will arouse consumers to the necessity of procuring a more wholesome sweet. These frauds are becoming truly fearful, inasmuch as we are injured, not only pecuniarily, but in what is far more important to us, health. The State Board of Health in Michigan, conceiving the evil to be beyond farther toleration, has been actively engaged in determining the exact character of these vile productions. Dr. Kedzie, of the Michigan Agricultural College, has analyzed syrups purchased of reliable grocers, and fifteen out of seventeen samples showed the presence of lime, copperas, and free sulphuric acid, to an alarming degree. According to a statement in a respectable paper, he found in some of them 140 grains of sulphuric acid, 30 of copperas, and 724 of lime, to the gallon. In the existence of such a state of things, it must be that an increased demand will arise for pure and reliable honey.

DIFFERENT QUALITIES OF HONEY.

The quality of honey depends materially upon the class of blossoms from which it is gathered. In our Northern latitudes, probably no finer flavored honey is to

be found than that gathered from Basswood, White Clover, and Raspberry. The color is light, and the flavor delicious. Buckwheat honey is considered the most inferior grade, being darker in color, and less agreeable in flavor. Between these are various grades, that from the Melilot or sweet clover being with us the most marked, and better in quality than the color would indicate. The honey from the White Sage of California is beautiful in color, but the flavor is inferior to that from Basswood. The idea entertained by some that honey can be manufactured from sugar by some mysterious process of the bees is totally erroneous. We need not occupy space in commending fine box-honey. Those who can indulge in it will appreciate the luxury. Yet it needs to be borne in mind by consumers that the quality of the honey is no better for being stored in dainty combs.

EXTRACTED HONEY.

Nothing in the progress of bee-keeping is more striking than the processes for securing honey free from comb. Compare the old-time "strained honey," flavored with bitter pollen, dead bees, and other dubious elements, with the pure, mint-flavored, snowy crystals of extracted honey which, next to a translucent comb filled with the nectar of a thousand blossoms, is the pride of the bee-keeper. It is beyond question that if, in the future, this sweet is included among the necessities or ordinary luxuries of the masses, it will be in the form of extracted honey. And that it is both cheap and desirable indicates that it will at no distant day take the place of deleterious syrups. Experiment in its adaptation to various culinary purposes will show its availability in many directions hitherto unthought of. If in a cask or can of honey that is candied hard, a hole is made in the center several inches deep, and a quantity removed, the liquid part of that at

the sides will drain into this cavity, when it may be dipped out, leaving the crystals nearly or quite dry, the condition depending upon the temperature. This grained honey may then be used in many ways, instead of sugar. It may also be drained by placing it upon a sieve.

ADULTERATION OF HONEY.

The extent to which fraud has been carried in respect to honey, demands the attention of all honest bee-keepers. When honey was retailing for from 25 to 50 cents per lb., there was a temptation to adulterate it with cane sugar, which was harmless in a sanitary point of view; but the reduction in the price of honey renders this form of fraud unprofitable. The evil which we are now called upon to combat, is the use of grape sugar and glucose.* It is gratifying to notice how promptly the effort to introduce the practice of feeding grape sugar to bees, has been met by Mr. Dadant, Dr. Shearer, and others. I observe with pride, the firm stand taken by the "American Bee Journal" against this threatening evil. It is possible to feed grape sugar to bees for their own use, and yet keep our surplus honey uncontaminated; but in this, as in the use of comb-foundation for boxes, I am disposed to take radical ground and protest against anything that gives a color of suspicion to our products. In order that consumers, and dealers as well, may be able to detect adulteration, a few facts concerning it may not be out of place. Let me say, first, that honorable dealers have it in their power to seek out perfectly reliable producers, and establish a lucrative trade on the basis of unadulterated products. The first fact to be understood is, that all granulated or candied honey is presumably pure. The natural infer-

* While grape sugar and glucose are chemically the same, the articles bearing these names in commerce are quite unlike. Commercial glucose, produced from starch by the action of acids, is a thick semi-liquid, very inferior in sweetness,

ence is, that such is the best to buy. If liquid honey is preferred, follow directions in Chap. XVI., and prepare it yourselves.

It is also well established that all pure honey will, as a general rule, granulate, if exposed to a sufficiently low temperature. To this rule exceptions have been reported, and such have occurred under my own observations, as will soon be noticed. Thus, ordinary honey remaining liquid in cold weather, when exposed to the air, should be regarded as suspicious, and put to a test. The presence of glucose in such honey may be ascertained as follows: Place a small quantity in a cup, and add to it some strong tea. If the poorer grades of glucose are present, it will turn dark, like ink. If it is combined with the better qualities of glucose, the fact may be determined by the use of a little alcohol. Pure honey will unite with alcohol, but glucose has no affinity for it, and they will separate, like oil and water. A common method of adulteration has been practised by placing a piece of fine comb-honey in a jelly cup and filling it up with glucose. If this were pure honey it would become candied and conceal the comb. Yet these are found unchanged upon our grocers' shelves the year round. If honey is put in a can, and heated and sealed, the same as fruit is canned, it will remain liquid until opened. The specimens of comb mentioned above could not have been thus treated, as the process would have melted the comb.

It has been said that the simple addition of water would prevent granulation, but this is not true. The usual effect is, when in a cool place, for the honey to be thick and candied at the bottom, and thin at the top; and if in a warm place, it will be likely to sour. Experiments indicate that the presence of moisture is necessary to produce granulation. I have thoroughly evaporated the moisture, and at the same time, expelled the air from a vessel of honey, so that it would stand open in a cold,

dry place, during the entire winter, without change. But the honey was so dense after this complete evaporation, as hardly to run when the can was inclined to one side; being very different in this respect from the liquid honey offered for sale in cold weather. I have known honey thus treated, to remain uncandied in a large vessel even when frequently disturbed, which corroborates my view of the influence of moisture. These instances being subject to special treatment, can hardly controvert the statement as to the doubtful nature of honey that remains uncandied when exposed to cold.

The obvious course for bee-keepers, in the matter of adulterations, is, first of all, to secure legislation that will effectually prohibit this unprincipled traffic. Stringent laws of this character are successfully carried out in foreign countries. Bee-keepers may, individually, place their products above question, by fair and open dealing, and avoiding any practices that may arouse even the slightest suspicion. Consumers and dealers have it in their power to protect themselves by observing the facts and tests mentioned, and last of all, almost any one disposed, can supply his own household and table with this desirable sweet, by following Mr. Quinby's oft-repeated advice to appropriate the "honey wasting at their own doors, which may be had, not for the asking, but for the taking."

CHAPTER XIX.

NOTES FOR THE SEASONS.

SPRING.

Bees should not be allowed to fly during March and early April in our northern latitude, if it can be prevented. Those in-doors should be left as quiet as

possible. It is usually safe to set them out just before Soft or Red Maple blooms. At this time there will probably be but little brood in the hives, but after the first flight, the queen will commence depositing eggs. Each hive should now be examined to ascertain its exact condition. In making these examinations it will be convenient to begin with a clean, empty hive. Remove the hive from its stand and put the empty one in its place. Take out the combs and put them into the empty hive. Eggs in the cells will attest to the presence of a queen. Set aside such combs as are not occupied by the bees, leaving those that contain honey. After cleaning this hive thoroughly, use it for the next one in the same manner until all have been inspected. If any are found destitute of sealed honey, supply them from such as have a surplus, or with combs reserved for the purpose.

If colonies are found to be queenless, or possessing deficient queens, unite them with others having queens. It will often be judicious to unite weak colonies.

Keep entrances contracted, to prevent robbing, and shut off all upward ventilation, to retain the warmth.

Stimulate breeding, and see that no stock is destitute of food at any time. Add empty combs as rapidly as the stocks become populous enough to demand it. This is the time to purchase bees, and transfer them from box-hives to movable comb-hives.

Cards of brood may often be taken from the best stocks and used to strengthen weaker ones to advantage. Fill the place of such cards with clean, empty combs. It is often best to place these in the center of the strong swarms, in such a position in the brood-nest that the queen will immediately occupy them. It is under such favorable circumstances as these that the largest number of eggs is deposited in a single day.

In some sections the best colonies will sometimes send

out swarms in May, for which hives should be in readiness. Queen-rearing may be begun, if desired.

Look well to any scarcity of honey that may occur, and supply all deficiencies by feeding.

SUMMER.

Arrange hives for boxing and extracting.

Have everything in readiness for swarms, if this system is to be practised.

Rear queens, and make artificial swarms.

Ventilate strong swarms in the warmest weather.

Remove surplus boxes as soon as full, and supply the place of the first ones with empty boxes.

Look out for the moth-larvæ, in surplus honey, and extra combs.

Extract at suitable intervals.

If preparations are to be made for wintering bees indoors, the work should be done in warm weather, that all damp material may be well dried before the room is occupied by the bees. Do not neglect refuse comb designed for wax.

AUTUMN.

Prepare bees for winter, and see that all stocks are in condition to rear young bees for winter.

Supply all deficiencies in queens.

Secure the fall yield of honey in combs for future use, or have new combs built for guides in boxes.

Prepare honey for market. The development of a home trade should be borne in mind at all times. A good local market is an important item with all producers. Reserve a sufficient amount of honey, when shipping, to meet such demands.

Place bees in winter quarters early, and observe the instructions given for wintering.

WINTER.

If all requirements have been observed, bees will now need but little care.

Attend to proper ventilation and temperature, as required by changes of the weather.

Prepare hives, boxes, and other material for the coming season.

Clean up and pack away boxes that are to be used the second time.

Read and study out subjects of interest; and be ready to begin the ensuing season's work promptly, with an adequate comprehension of the extent of the business to be conducted, and a just appreciation of the details therein involved.

CHAPTER XX.

CONCLUSION.

Those who have perused these pages with care will notice that I have not dwelt largely upon the most favorable aspects of our pursuit, but have endeavored to present all its phases in a candid and unbiased manner. Undoubtedly the cause of many failures lies in the unwarranted anticipations of beginners. The extremes which are incident to the business make it impossible to test it fairly, with the experience of but one or two years. The united results of a series of years must be averaged in order to arrive at a proper estimate of profits. This being done, I conceive that it offers a fair prospect of reasonable remuneration for labor and capital invested, and is a calling which develops a healthy consciousness of "earning one's bread by the sweat of the brow."

Although the amateur may not be able to keep bees on

a small scale as profitably as the specialist with all conveniences at his command, yet there is ample argument in favor of small ventures in this direction. The gain is not altogether pecuniary, or in the gratification of the palate. To those engaged in sedentary pursuits, a chance for healthful exercise and diversion is often more than these. Beyond all these there is yet a higher good. All intimacy with the operations of nature has a silent but beneficent influence. Whatever tends to develop our perceptions of the wonders of creation, even as manifest in the mission of a tiny bee, can but cause us to "look beyond these results to their Divine Author."

INDEX.

Acer rubrum..... 49
Acer saccharinum..... 50
Adulteration of Honey..... 258
" Syrups... 256
After Swarms..... 162
Alders..... 49
Alighting Board..... 113
Allen, John..... 22
"American Bee Journal"..... ... 21
"Anatomy and Physiology of the Honey Bee"..... 22
Ants and Bees.....231
Apiarian, Preparation Needed..... 66
Apiary, Arrangement of..... 70
" Building in..... 70
" Cost of Bees..... .. 81
" " Fixtures..... 82
" Financial Results..... 84
" Gravel in..... 73
" Home..... 77
" Location of..... 67
" Moving in..... 76
" Overstocking... 85
" Sawdust in.... 73
" Shade in 76
" Shelter Needed..... 68
" Water Near..... 68
Apple Blossoms..... 50
Artificial Comb.... 193
Asclepias Cornuti..... 53
Asilus Missouriensis..... 229
Autumn, Work for.....152
Balm of Gilead 29
Balsam Poplar..... 29
Basswood..... 55
" Yield of Honey..... 56
Bee-bread..... 28
Bee-houses..... .. 77
"Bee Journal" 20
"Bee-Keeper's Directory"..... 19
"Bee-Keeper's Guide."..... 21
"Bee-Keeper's Magazine."..... 21
Bee-keeping in Cities and Villages.. 69
" Journals..... 20
" Old and New..... 17
Bee-killer..... 229
Bee-moth 177-223
Bee-veil... 92
Bees, Artificial Increase.....165
" Carniolans..... 48
" Colony, Numbers..... 26
" Controlled by Smoke... 89
" Controlling..... 87
" Controlling Swarming.....168
" Cost of..... 81
" Cyprians..... 47
" Diseases and Enemies of.....216
" Disposition 87
" Do they Injure Fruit?..... 63
" Drone..... 26
" Drone-laying Queen.....149
" Dividing Colonies.....166
" Eggs and Hatching..... 32
" Enemies 216
" Excrement of..... 254
" Feeding..... 204
" Fertilizing Queen.....131
" Financial Results from..... 84
" Flying in Winter.... 253
" Foul Brood in..... 217
" Generation in..... 35
" Hiving Swarms.....158
" How far will they go? 65
" How to Select..... 80
" Houses for..... 77
" in Warm Climates..... 27
" Italian..... 39
" Italian, Characters of..... 40
" Italian, Excellencies Claimed..... 41
" Italians and Natives Compared..... 47
" Italians, how to procure.... 47
" Injured by Silk-weed..... 53
" Ligurian..... 39
" Marking Location..... 73
" Moving for Pasturage..... 65
" Moving Short Distances..... 74
" Natural Increase.....152
" Nucleus System for Queens. 137
" Overstocking 85
" Parasites of.....217-219

Bees, Persons Offensive to..... 88
" Preparing for Transportation..... 83
" Preparing for Winter.....241
" Preventing Drones.....130
" Protection from..... 92
" Queen 23
" Queens, Rearing.....132
" Queens, Selecting.....129
" Quiet in Winter Essential...244
" Robbing. 212
" Setting Out in Spring.....253
" The Sting of..... 25
" Swarming of.....34–152
" Syrians 47
" Taking on Shares..... 84
" Transferring.....125
" Transportation of, Beneficial. 80
" Transporting 82
" When to Purchase... 79
" When to Take in.....250
" Where to Buy..... 97
" Wintering.....241
" Wintering in Cellar.....248
" Wintering in Clamps.. 250
" Wintering, Dryness Essential.....247
" Wintering In-doors.....246
" Wintering in Quinby Hive...243
" Wintering, Heat in.....246
" Wintering Out-of-doors.....244
" Wintering, Building for.... .249
" Worker..... 24
Birds 230
Block for Setting Up Boxes.....118
Borage..... 52
Bottles for Honey 241
Bottom Board, Large.... 110
" " Small 107
Box for Queen Cell..... 141
Box-honey, Care of..... 176
Boxes, Block for Setting Up.....118
" Clamp for.....123
" Honey 115
" Putting on.....172
" Removing..... 175
" Section 120
" Single Comb.....120
" Standard for.....119
" Supplying..... 173
" Two-comb 117
Boxing and Surplus Honey.. 172
Bread, Bee..... . . 28
Brood-nest, Form of..... 30
Brood-rearing..... 30
Buckwheat..... 60
Buildings for Wintering.....249
Bush Honeysuckle..... 53
Button Bush..... 59
Candied Honey.....239
Cases, Making.....237
" Marking 236
Cat-bird, Useful..... 231
Catnip..... .. 52
Cellar for Wintering Bees..... ...248
Cells, Distorted.....197
" How Filled..... 29
" Size of.. 192
Cephalanthus occidentalis..... 59
Chrysalis... 33
Chrysanthemum Leucanthemum... 52
Cider-mills Attract Bees..... .. 64
Clamp for Boxes.....123
" " Wintering..... 249
Clasp for Hive, Quinby's.....111
" Van Deusen's.....184
Clipping Queen's Wings.....147
Clover, Alsike..... 51
" Red..... 51
" Sweet-scented..... 60
" White..... 50
Cocoon.... 32
Comb, Artificial.....193
" and Wax.....190
" Construction of..... 27
" Cost of.....193
" Foundation.....195
" " Wire in.....196
" How Built 191
" in Unnatural Position..... 72
" Material for.....194
" Size of Cells..... 192
Combs, Filling for Feeding.....209
" Guide.....122
" Metallic.....194
" Securing Extra.....189
" " Guide.....189
" Straight.....168
Coe's House Apiary..... 77
Colony Consists of..... 23
Controlling Bees..... 87
Cook, Prof. A. J., Book..... 22
Cook, Prof., on Impregnation..... 37
Cost of Bees and Fixtures..... 81
Cotton..... 61
Daisy, Ox-eye..... 52

Dandelion..... 50
Diervilla trifida..... 53
Dipsacus Fullonum..... 57
" sylvestris..... 57
Diseases, Dysentery.....216
" Foul Brood.....217
" of Bees.....216
Distance Bees Fly..... 64
Distorted Cells..... 197
Dividing Colonies.....166
Division Board.....101
Dress for Bee-keeper..... 92
" " Women..... 93
Doolittle, G. M., on Teasel..... 57
Drone Cells..... 33
Drone, Described..... 26
Drone-laying Queens.....149
Drones Destroyed..... 35
" Preventing.....130
Dryness in Winter.....247
Dysentery.....216
Dzierzon on Generation..... 35
Egg-laying, Process of..... 31
Eggs, Hatching..... 32
" Impregnation of..... 36
" Size of..... 31
Evaporator for Honey.....188
Excrement, Healthy Always Dry...254
Extracted Honey..... 257
" " Curing..... 187
Extracting, Arranging Hives for.. 183
" Honey..... 180
" How.....185
" When..... 183
Extractor, Desirable Features..... 182
" Wax..... 202
Feeder, Van Deusen's..... 207
" With Quinby Hive.....206
Feeding in Combs..... 209
" Necessity for.....204
" Preparing Food..... 206
" Spring..... 210
" Surplus.....210
" What?.....205
Fertile Workers..... 38
Food, Preparing..... 206
Food Should be Warm.....211
Foul Brood.....217
" " Due to Fungus.....218
" " Remedy..... 218
Foundation Comb..... 195
" in Boxes..... 200
" Machine.....198
Foundation Machine, Cost of.....201
" To Fasten.....200
" Use and Value of.....199
Frames, Form for Making.....106
" Hanging.....100
" Section.....116
Fruit Tree Blossoms..... 48
Fuller's Teasel..... 57
Generation..... 35
Girdwoyn, Michel..... 22
Gleanings in Bee Culture..... 21
Golden Rods..... 60
Grading Honey..... 236
Grain, Do Bees Injure?..... 62
Guide Combs.....122
" " Securing.....189
Hanging-Frame Hive..... 96
Harbison, J. S..... 19
Heat Needed in Winter.....246
Hetherington, Capt. J. E., Memorial of M. Quinby..... 13
Hives, Accuracy is Essential.....115
" Alighting Board for.....113
" Arrange for Extracting.....183
" Arrangement in Apiary..... 71
" Case for.....108
" Clamp for Boxes.....123
" Clasp for.....111
" Complete Quinby.....109
" Distance Between..... 72
" Guide Combs..... 122
" Hanging Frame.....96-100
" Honey Board..... 118
" Honey Boxes.....115
" Iron Roof..... 76
" Langstroth's..... 97
" Movable Comb..... 95
" Non-Swarming.....168
" Observatory..... 102
" Painting..... 114
" Quinby, Bottom-Boards 107-110
" Quinby, Panel for..... 107
" Quinby, The New..... 103
" Quinby, With Roof.....112
" Roofs for.....76-113
" Setting Level..... 72
" Section Frames Objected to.116
" Separators..... 122
" Side-Boxing..... 101
" Standing Frame..... 105
" Stands for.....73-112
" Upon Roofs..... 70
Hiving a Swarm.....158

Honey, Adulteration of.... 258
" Best Season for..... 66
" Buckwheat 60
" Care of Box.....176
" Cases for.....237
" Curing Extracted.....187
" Dealers in.....237
" Different Qualities of.....256
" Extracted 257
" " Packages for....239
" " Preparing for Market..... . .. 238
" Extracting..... 180
" Gathering and Storing..... 28
" Grading 236
" How to Extract.....185
" Liquefying Candied.....239
" Marketing.... 232
" Packing.....236
" Securing Choice.....178
" Sources of..... 48
" Surplus..... 172
" Teasel... 58
" Transportation of.....238
" Uses of... 255
" Yield of Basswood..... 56
Honey-boxes..... 115
Honey-dew 61
Honey-extractor..... 180
Honey-knives.....188
Honey-plants, Early..... 49
" " Later.... 59
Insects and Diseases.....216
" Ants..... 231
" Bee-killer.....229
" Bee-moth..... 223
" Foul Brood.....217
" Honey-bug.... 222
" Spiders.....231
" Trichodes Apiarius.....222
Honey Board.....118
Honey Bug.....222
Honeysuckle, Bush..... 53
Horehound..... 52
Hornets Injure Fruit..... 64
House Apiary..... 77
Increase, Artificial.....165
" Natural.....152
Introducing Queens.....144
Italian Bees.... 39
Italians, Characteristics of..... 40
" Compared with Natives... 47
" Excellencies Claimed..... 41
Italians, How to Procure..... .. 47
Journals, Bee..... 20
King, A. J. & Co. 21
King-Bird Killing Bees.....230
Knife for Uncapping..... ..188
Langstroth, Rev. L. L..... 19
"Langstroth on the Honey Bee,".. 21
Langstroth's Hive..... 95
Larva..... 32
Larvæ, Feeding of..... 32
Leonurus Cardiaca..... 52
Leucanthemum vulgare..... 52
Lewis, Hon. Harris, Cider Mill..... 64
Ligurian Bees..... 39
Linden..... 55
Liriodendron Tulipifera..... 55
Locust..... 50
Loss of Queen.....151
Magnifying Glass.....223
"Manual of the Apiary,"..... 22
Maple, Red..... 49
" Soft..... 49
" Sugar.... 49
Marketing Honey.. 232
" Large Cases.....233
" Small Cases.....233
" Preparing Boxes.....235
Marrubium vulgare... 52
Melilot..... 60
Melon Family..... 59
Memorial of M. Quinby..... 13
Mice and Rats..... 229
Michigan State Agr'l College..... 67
Microscope 223
Mignonette..... 59
Milk-weed..... 53
Motherwort..... 52
Moth-proof Hives.....223
Movable Comb-hive..... 95
" " Advantages... 95
Moving Bees..... 74
Mustard..... . .. 59
"Mysteries of Bee-keeping Explained"..... 18
Nellis, J. H..... 21
" " House Apiary..... 78
Nepeta Cataria..... .. 52
"New Bee-keeper's Text Book"... 22
Newman, Thos. G. & Son..... 21
Nucleus Box..... 133
Non-swarming Hives.... 168
Nymph 33
Observatory Hive.....102

Overstocking..... 85
Ox-eye Daisy..... 62
Packing Honey.....236
Painting Hives.....114
Panels for Side of Frames.....104
Parasites.....219
" Honey-bug.....222
" Trichodes Apiarius.....222
Partheno-genesis..... 35
Pollen from Pumpkins..... 59
" Gathering and Storing..... 27
" Sources of..... 49
Poplar, Balsam..... 29
" Balm of Gilead..... 29
Populus Balsamifera..... 29
" " Var. Candicans..... 29
Preparing Extracted Honey for Market.....238
Propolis..... 29
Protection from Bees..... 92
Prunus serotina..... 50
" Virginiana..... 50
Puff-ball for Smoke..... 89
Pumpkins..... 59
Pupa..... 33
Purchasing Bees..... 79
Queen, Age of..... 148
" Cages.....142
" " to Make.....143
" Cell Box.....141
" Cells..... 33
" Depriving of.....170
" Described..... 23
" How to Handle.....147
" Loss of.....151
" Meeting the Drone..... 34
" More than One in a Hive...152
" Nuclei to Form.....140
" Nucleus System.....137
" Nursery.....136-142
" Time to Mature..... 34
" Unimpregnated, Lays Drone Eggs..... 35
Queens, Clipping the Wings.....147
" Destroyed..... 35
" Drone-Laying.....149
" Fertilization in Confinement.....131
" Good Stock Imported.....129
" Introducing.....144
" How to Rear.....133
" Spent..... 150
Queens, When to Rear.....132
Quinby, M., Memorial of..... 13
" Hive for Wintering.....243
" " The New.....103
" " with Roof.....112
" on Impregnation..... 36
Quinby's Bellows Smoker. ...90-91
" Hive Clasp.....111
" New Hive, Complete.....109
Raspberry, Red..... 50
Rats and Mice.....229
Red Raspberry..... 50
Remedies for Stings..... 94
Rendering Wax.....201
Robbing by Bees.....212
" Indications of.....214
" Remedies for.....215
Roof for Hive.....113
" " Quinby Hive.....112
Root, A. I..... 21
Rhus glabra..... 58
Robinia Pseudacacia..... 50
Rumex Acetosella..... 52
Sage, White..... 61
Salix alba, var. vitellina..... 49
Season, Best for Honey..... 66
Seasons, Hints for Exceptional....171
" Notes for.....260
Section Boxes.....120
" " To Make.....121
" Frames.....116
Selecting Swarms..... 80
Separators.....122
Silk-Weed..... 53
" Fatality of..... 53
Sinapis nigra..... 59
Single Comb Boxes.....120
Skunk Cabbage..... 49
Smoke, Materials for..... 89
" to Control Bees..... 89
Smoker, Quinby Bellows..... 90
Smokers..... 90
Solidago..... 60
Sorrel..... 52
Sources of Honey..... 48
" of Pollen..... 49
Spent Queens.....150
Spiders and Bees.....231
Spring, Work for.....260
Standard for Boxes.....119
Standing-Frames.....105
Stands for Hive.....112
" " Hives..... 73

Sting, Structure of..... 25
" to Extract..... 94
Stinging, Causes of..... 87
Stings Avoided by Boldness..... 93
" Remedies for..... 94
Sugar Maple.. 49
Sumach..... 58
Summer, Work for.....262
Swarming..... 34–152
" Controlling.... ... .168
" Indications of.....155
" Preparations for..... 156
" Time of.....154
Swarms, After.....162
" " To Prevent.....163
" Dividing. 166
" How to Hive.....158
" How to Select..... 80
" More than One..... 161
" Returning.....162
" Separating.....161
" What Bees Compose.....157
Sweet-scented Clover. 60
Symplocarpus fœtidus..... 49
Syrups, Adulteration of..... ..256
Taraxacum Dens-leonis..... 50
Teasel, Fuller's..... 57
" Wild..... 57
Thermometer.....249
Tilia Americana..... 55
Toads and Bees.....231
Transferring Bees. 125
" Board 126
" Sticks..... 126
Transportation Beneficial..... 80
" of Honey.....238
Transporting Bees..... 82
Trichodes Apiarius.....222
Trifolium hybridum 51
" repens 50
Tulip-tree..... 55
Uses of Honey..... 255
Van Deusen's Clasp.....184
" Feeder.....207
Wagner on Fertilization..... 36
Wagner, Samuel..... 20
Wasps Injure Fruit..... 64
Wax and Comb 190
" Extractor, Jones'.....203
" " Swiss.....202
" How Produced 190
" Making into Sheets.....196
" Moulding ... .203
" Rendering..... 201
White Clover..... 50
" Sage 61
" Weed..... 52
" Wood 55
Wild Cherry..... 50
Willow, Golden..... 49
Willows..... 49
Winter, Preparing for. 241
" Work for..... 263
Wintering Bees.... 241
" Out-of-Door..... 244
" When to Begin 252
Wire in Foundation..... 196
Women, Bee-dress for..... 93
Workers, Described..... 24
" Fertile 38
" Life of 26
Wrens, Useful.....231

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